THE
NEW GRESHAM
ENCYCLOPEDIA

VOLUME X

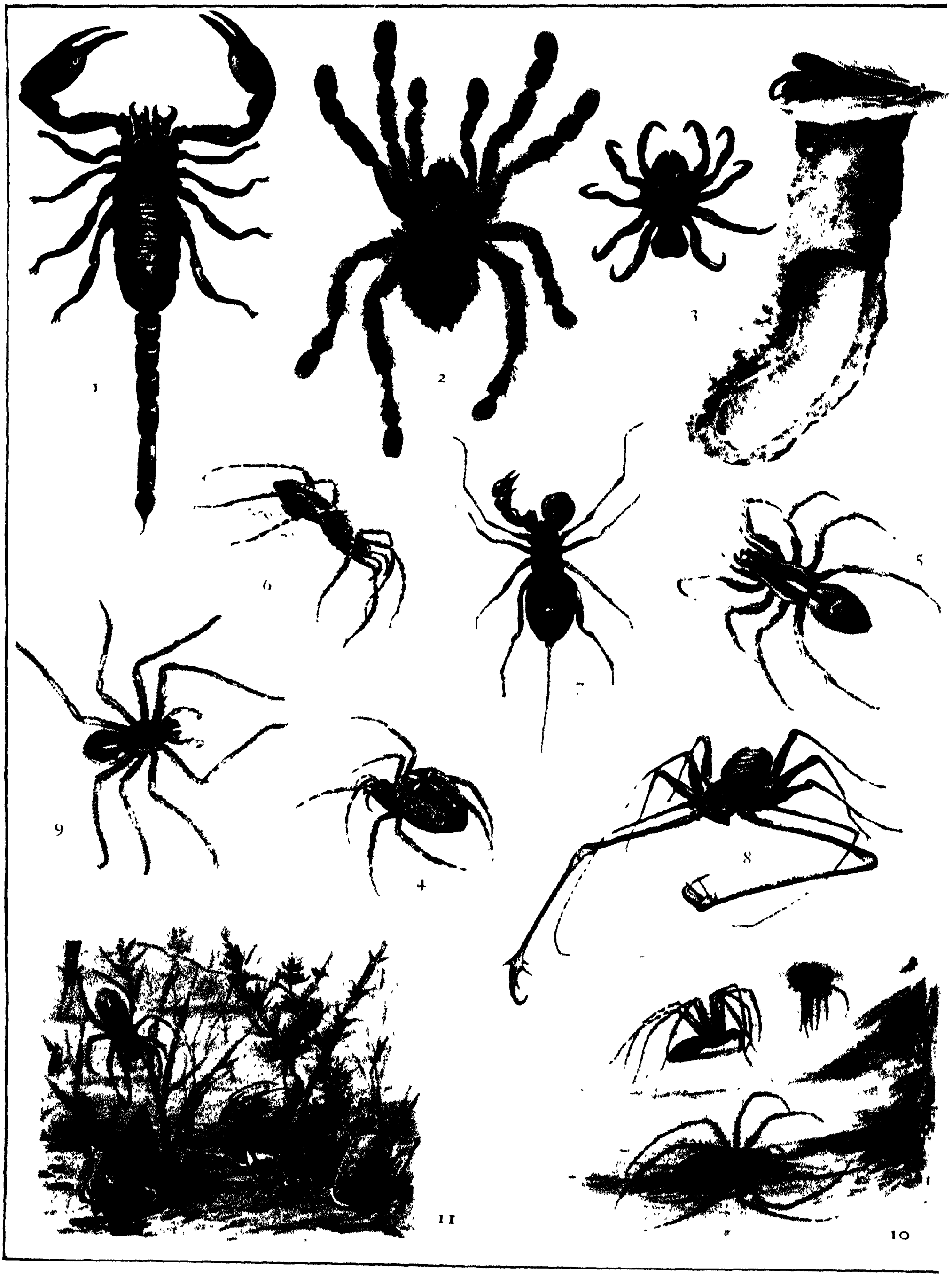
EDITORS

ANGELO S. RAPPOPORT, Ph.D., B. ès L.

R. F. PATTERSON, M.A.(Cantab.), D.Litt.(Glasgow), F.S.A.Scot.

JOHN DOUGALL, M.A., D.Sc., F.R.S.E.; Gold Medallist of the Royal Society of Edinburgh.

SPIDERS AND SCORPIONS



1, African Scorpion. 2, Mygale Spider. 3, Jamaican Trap-door Spider and burrow. 4, Common Garden Spider. 5, Italian Tarantula. 6, Wolf Spider carrying cocoon. 7, Whip Scorpion. 8, Tarantula phipsonia. 9, South African Walking Spider. 10, Spiders of Agelenidæ family. 11, Water Spiders.

THE NEW-GRESHAM ENCYCLOPEDIA

VOLUME X

THE-GRESHAM-PUBLISHING
COMPANY-LIMITED
LONDON

Printed in Great Britain

LIST OF PLATES AND MAPS

VOLUME X

PLATES

Page
Spiders and Scorpions - - - - - - *Frontispiece*
Sculpture - - - - - - - - - - - - 126
Sheep - - - - - - - - - - - 184
Steam-ships - - - - - - - - - 196
Steam-engines - - - - - - - - 366

MAPS IN COLOUR

Russia in Asia - - - - - - - - - 32
Russia in Europe - - - - - - - - - - 38
Scotland - - - - - - - - - - - - 108
South Africa and Rhodesia - - - - - - - - 284
South America - - - - - - - - - - - 288
Spain and Portugal - - - - - - - - - - 298

CONTRIBUTORS TO VOLUME X

Sir W. S. Abell, K.B.E., M.Eng., M.Inst.N.A., M.Inst.C.E.

George E. Allan, D.Sc., Lecturer in Electricity, University of Glasgow.

John Allan, M.A., M.R.A.S., Assistant Keeper, British Museum.

C. O. Bannister, F.I.C., Assoc. R.S.M., Professor of Metallurgy, University of Liverpool.

Lionel D. Barnett, M.A., Litt.D.

James W. Campbell, M.Sc., A.M.I.Mech.E., A.M.I.E.E.

Harold H. Child, B.A., former Scholar of Brasenose College, Oxford.

Grenville A. J. Cole, F.R.S., Professor of Geology, Royal College of Science, Ireland.

W. G. Constable, M.A., Fellow of St. John's College, Cambridge.

Arthur O. Cooke, Author of *A Book of Dovecotes*.

Miss Margaret H. Cunningham, Director of the Sunday School Union.

J. R. Ainsworth Davis, M.A., F.C.P., former Principal of the Royal Agricultural College, Cirencester.

John Dougall, M.A., D.Sc., F.R.S.E., Gold Medallist of the Royal Society of Edinburgh.

Montagu Drummond, M.A., Professor of Botany, Glasgow University.

R. E. Garrod, M.A., A.I.C., Clare College, Cambridge.

Moses Gaster, Ph.D., Author of *History of Rumanian Popular Literature*.

Percy Gordon, Mus.Bac.

Charles Gourlay, B.Sc., F.R.I.B.A., Professor of Architecture and Building, Royal Technical College, Glasgow.

H. J. C. Grierson, M.A., LL.D., Professor of Rhetoric and English Literature, Edinburgh University.

Maurice G. Hannay, M.D., F.R.C.P. (Edin.).

A. M. Henderson, L.R.A.M., A.R.C.M.

H. Y. Hills, Assoc. M.Inst.C.E.

W. A. Hislop, M.B., late Captain, R.A.M.C.

A. W. Johns, C.B.E,, R.C.N.C., Mem. Council I.N.A.

Tudor Jones, M.B., Ch.B.

F. W. Law, B.Sc., late Lecturer in Forestry, West of Scotland Agricultural College, Glasgow.

Donald A. Mackenzie, Folklorist; Author of *Ancient Man in Britain*, &c.

W. C. Mackenzie, F.S.A.Scot., Author of *A Short History of the Scottish Highlands and Isles*.

R. F. Muirhead, B.A.(Cantab.), D.Sc.

D. G. Ogilvy, LL.B.

Edward W. O'Hara.

R. F. Patterson, M.A., D.Litt., F.S.A.Scot., formerly Charles Oldham Shakespeare Scholar, Cambridge University.

Robert S. Rait, C.B.E., M.A., LL.D., Historiographer-Royal for Scotland; Professor of Scottish History and Literature, Glasgow University.

Angelo S. Rappoport, Ph.D., B. ès L.

F. W. Raynes, Lecturer in Plumbing, Royal Technical College, Glasgow.

William Riddet, N.D.A., N.D.D.

Walter Ripman, M.A., Chief Inspector to the University of London.

John J. Ross, M.A., F.R.A.S.

G. Elliot Smith, M.A., M.D., F.R.S., Professor of Anatomy, University of London.

C. S. Stooks, D.S.O., Lieutenant-Colonel, Indian Army; Instructor in Military Organization, Royal Military College, Sandhurst.

M. M. J. Sutherland, D.Sc., F.I.C.

Gilbert Thomson, M.A., F.R.S.E., M.Inst.C.E., Lecturer on Sanitary Science, Royal Technical College, Glasgow.

W. C. D. Whetham, M.A., F.R.S., Fellow and formerly Senior Tutor of Trinity College, Cambridge; Author of *Theory of Solution*.

H. St. John L. Winterbotham, C.M.G., D.S.O., Lieutenant-Colonel, R.E.

George M. Wishart, B.Sc., M.B., Grieve Lecturer in Physiological Chemistry, Glasgow University.

Thomas Woodhouse, Head of the Weaving and Designing Department, Dundee Technical College and School of Art.

Harold Wright, M.A., Pembroke College, Cambridge.

KEY TO PRONUNCIATION

The method of marking pronunciations here employed is either (1) by markin the syllable on which the accent falls, or (2) by a simple system of transliteratio to which the following is the Key:—

VOWELS

ā, as in fate, or in bare.
ä, as in alms, Fr. *â*me, Ger. Bahn=á of Indian names.
ȧ, the same sound short or medium, as in Fr. bal, Ger. Mann.
a, as in fat.
a̤, as in fall.
a, obscure, as in rural, similar to *u* in but, ė in *her: common in* Indian names.
ē, as in me=*i* in machine.
e, as in met.
ė, as in her.
ī, as in pine, or as *ei* in Ger. mein.
i, as in pin, also used for the short sound corresponding to ē, as in French and Italian words.
eu, a long sound as in Fr. jeûne=Ger. long as in Söhne, Göthe (Goethe).
eu, corresponding sound short or medium, as i Fr. peu=Ger. *ö* short.
ō, as in note, moan.
o, as in not, soft—that is, short or medium.
ö, as in move, two.
ū, as in tube.
u, as in tub: similar to ė and also to ***a***.
ṳ, as in bull.
ü, as in Sc. abune=Fr. *û* as in *dû*, *Ger.* *ü* lon as in grün, Bühne.
u̇, the corresponding short or medium sound, a in Fr. but, Ger. Müller.
oi, as in oil.
ou, as in pound; or as *au* in Ger. Haus.

CONSONANTS

Of the *consonants*, **b**, **d**, **f**, **h**, **j**, **k**, **l**, **m**, **n**, **ng**, **p**, **sh**, **t**, **v**, **z**, always have thei common English sounds, when used to transliterate foreign words. The letter **c** i not used by itself in re-writing for pronunciation, **s** or **k** being used instead. Th only consonantal symbols, therefore, that require explanation are the following:—

ch is always as in rich.
d, nearly as *th* in *th*is=Sp. *d* in Madrid, &c.
g is always hard, as in go.
h represents the guttural in Scotch loch, Ger. nach, also other similar gutturals.
ṇ, Fr. nasal *n* as in bon.
r represents both English *r*, and *r* in foreign words, which is generally much more strongly trilled.
s, always as in so.
th, as *th* in *th*in.
th, as *th* in *th*is.
w always consonantal, as in *w*e.
x=ks, which are used instead.
y always consonantal, as in *y*ea (Fr. *lign* would be re-written lēny).
zh, as *s* in pleasure=Fr. *j*.

THE NEW GRESHAM ENCYCLOPEDIA

VOLUME X

Rome, two cities of the United States. (1) A city of New York, the county seat of Oneida county. Brass-, copper-, wire-, and locomotive-works, machine-shops, and canneries provide the chief employments. The city stands in the heart of an agricultural area noted for market gardening and dairying. Pop. 26,000. (2) A city of Georgia, the county seat of Floyd county. Manufactures include cotton and cotton-seed oil, agricultural machinery, and foundry- and machine-shop products in general. The adjacent county is rich in mineral wealth—bauxite, iron, coal, limestone, slate, and marble. Pop. 13,500.

Romford, an urban district and ancient market town of Essex, England, on the Rom; served by the Great Eastern Railway. It is celebrated for its ale. Pop. (1921), 19,448.

Rom'illy, Sir Samuel, British lawyer and legal reformer, born 1757, died 1818. He was called to the Bar in 1783, and gradually rose to be leader in the Court of Chancery. In 1805 he was appointed Chancellor of Durham, and next year he became Solicitor-General under Fox and Grenville. When his party went out of office he remained in Parliament, where he became distinguished by his talent in debate, and particularly by the eloquence with which he urged the amelioration of the cruel and barbarous penal code which then prevailed. Sir Samuel Romilly was at the height of popularity and reputation when, in a fit of temporary insanity, caused by grief at his wife's death, he committed suicide.

Romney, George, English painter, born near Dalton, Lancashire, in 1734, died at Kendal in 1802. The son of a carpenter, he first worked at his father's trade, but afterwards was apprenticed to an artist named Steele at Kendal. After some local success he went to London in 1762, and rapidly rose to fame, soon becoming a formidable rival to Reynolds. He visited Italy in 1773, settling again in London in 1775. Though he attempted some historical and imaginative compositions, his reputation rests on his portraits. His most famous sitter was Emma Hart, afterwards Lady Hamilton, and her features tend to reappear in most of his other portraits of women. Notwithstanding the charm and grace of his design, which Reynolds was not ashamed to imitate, the lack of individuality, the over-pretty colour, and the facile empty handling of his work put him below his great contemporaries. Though one of the leading artists of the day, he never exhibited at the Royal Academy. He is well represented in the National and Tate Galleries.—BIBLIOGRAPHY: John Romney, *Memoirs of the Life and Writings of George Romney*; H. Gamlin, *G. Romney and his Art*; H. Ward and W. Roberts, *Romney*; W. Hayley, *The Life of G. Romney*; H. E. Maxwell, *G. Romney*.

Romney, New, a small but ancient municipal borough of England, in Kent, one of the Cinque Ports; served by the South-Eastern & Chatham Railway. It was formerly on an estuary where the River Rother entered the sea, but the river-course was altered by a great thirteenth-century storm, and with the gradual accretion of land Romney is now an inland town. Pop. 1500.

Romorantin (ro-mo-rȧṇ-taṇ), a town of France, in the department of Loir-et-Cher. Manufactures include woollen goods and parchment. Pop. 8200.

Romsey, a municipal borough of Hampshire, England, on the Test. The abbey church of SS. Mary and Elfleda is a fine specimen of pure Norman architecture. Pop. (1921), 4830.

Rom'ulus, the mythical founder and first King of Rome. His mother was the Vestal virgin, Sylvia or Ilia, a daughter of Numitor, King of Alba. By the god Mars she became the mother of the twins Romulus and Remus, who were ordered by Amulius, the usurping brother of Numitor, to be thrown into the Anio. The basket containing the two boys was stranded beneath a fig tree at the foot of the Palatine Hill, and they were suckled by a she-wolf and fed by a woodpecker, until they were accidentally found by Faustulus, the king's herdsman, who took them home and educated them. When they had grown up, they organized a band of enterprising comrades, by whose help they deposed Amulius and reinstated Numitor on his throne. They next resolved to found a city, but as they disagreed as to the best site for it, they resolved to consult the omens. The decision was in favour of Romulus, who immediately began to raise the walls. This is said to have happened in the year 753 (according to others 752 or 751) B.C. Remus, who resented his defeat, leaped over the rude rampart in scorn, whereupon Romulus slew him. Romulus soon attracted a considerable number of men to his new city by making it a place of refuge for every outlaw or broken man, but women were still wanting. He therefore invited the Sabines with their wives and daughters to a religious festival, and in the midst of the festivities he and his followers suddenly attacked the unarmed guests, and carried off the women to the new city. This led to a war, which was, however, ended at the entreaties of the Sabine wives, and the two states coalesced. Romulus is said finally to have miraculously disappeared in a thunderstorm (716 B.C.).

Ron′aldshay, North and South, respectively the most northerly and the most southerly of the Orkney Islands. North Ronaldshay, on which is a lighthouse, is about 3 miles long by 2 miles broad, and has a fertile and well-cultivated soil. Pop. 440.—South Ronaldshay, 6 miles from the mainland of Scotland, is about 7¾ miles long, with an average breadth of 2 miles. Its greatest elevation is 390 feet. The coast is much indented, and forms several good harbours. As in North Ronaldshay, the inhabitants are crofters, largely depending on the cod and herring fishery. Pop. (1921), 2101.

Roncesvalles (ron-thes-vȧl′yes), a village in Spanish Navarre, between Pamplona and St. Jean de Port, where the rear of Charlemagne's army was defeated by the Gascons or Basques in 778, and the paladin Roland killed. Tradition and romance erroneously ascribe the victory to the Moors.

Ronda, a town of Southern Spain, in the province of Malaga, most romantically situated on a sort of rocky promontory surrounded on three sides by the Guadalevin, which flows through the 'Tajo', a deep chasm separating the old Moorish town, with its narrow tortuous lanes and Moorish towers, from the modern quarter. Over this ravine there are two bridges—an old and a modern one. Ronda is famous for its bull-fights, for which it has one of the largest bull-rings in Spain. Pop. 23,000.

Rondeau, Rondel, and Roundel, a group of verse forms having a common origin. Originally these words were synonymous (*rondel* is merely an old form of *rondeau*, like *oisel* for *oiseau*), but for convenience each word has been, in quite modern times, applied to a slightly different form.

The *Rondeau* is the most popular of the three forms. It is written throughout on two rhymes, and is composed of thirteen lines and two unrhymed refrains. The refrain is usually made from the first half of the first line. The thirteen lines are grouped in three stanzas, the first and third having five lines each, the second consisting of three only. The refrain occurs at the end of the second stanza, and at the close of the poem. The rhyme order is a, a, b, b, a—a, a, b, refrain—a, a, b, b, a, refrain. Upon the skilful introduction of the refrain the success or failure of a rondeau depends. In the refrain the sound must reappear exactly, but the sense may—indeed should—be altered. An example will best illustrate what is meant:

A RONDEAU TO HELEN, BY REQUEST

Ah villain Nell! I must compose
A Rondeau, so you say! That shows
How much you over-rate my skill.
Apollo guide my erring quill,
And all my imperfections gloze!

Were mine a pen like E. A. Poe's,
Or Mrs. Harriet Beecher Stowe's—
But I am I—and you are still
A villain, Nell.

Hurrah! I'm getting near the close;
Just four more lines and then—! Here goes!—
N.B., when next I write I will
Select some form I write less ill
And send (if you prohibit prose)
A villanelle!

The rondeau is a highly artificial form of verse, but in the hands of an expert it is an inimitable vehicle for dainty wit. Voiture is the greatest master of the form.

The name *Rondel* is now given to an earlier type of rondeau, which consists of fourteen instead of thirteen lines, and which repeats the initial couplet in the middle and again at the close. The rhymes are often in this order: A, B, b, a—a, b, A, B—a, b, b, a, A, B (the refrain being marked by capital letters), or A, B, a, b—b, a, A, B—a, b, a, b, A, B. The rules for the rondel are not quite so rigid as those for the rondeau. Charles d'Orléans (1391–1465) was one of the greatest exponents of this form, and an example may be given from his works:

Allez-vous en, allez, allez,
Soussy, soing et merencolie;
Me cuidez-vous toute ma vie
Gouverner, comme fait avez?
Je vous promets que non ferez
Rayson aura sur vous maistrie:
Allez-vous en, allez, allez,
Soussy, soing et merencolie.

Si jamais plus vous retournez
Avecques vostre compaignie
Je prye à Dieu qu'il vous mauldie
Et le jour que vous reviendrez:
Allez-vous en, allez, allez,
Soussy, soing et merencolie.

The *Roundel* is a variation introduced by Swinburne in his volume *A Century of Roundels*. It consists of eleven lines including the refrain, and the rhyme order is a, b, a, refrain; b, a, b; a, b, a, refrain, but when the refrain consists of more than a single word it rhymes with the b lines. The lines vary from four to sixteen syllables, but are generally identical in length in the same roundel. Swinburne's roundel on the roundel may be given as an example:

A Roundel is wrought as a ring or a starbright sphere,
With craft of delight and with cunning of sound unsought,
That the heart of the hearer may smile if to pleasure his ear
A roundel is wrought.
Its jewel of music is carven of all or of aught—
Love, laughter, or mourning—remembrance of rapture or fear—
That fancy may fashion to hang in the ear of thought.

As a bird's quick song runs round, and the hearts in us hear—
Pause answers to pause, and again the same strain caught,
So moves the device whence, round as a pearl or tear,
A roundel is wrought.

Rondele′tia, a genus of shrubs, nat. ord. Rubiaceæ, characterized by having a calyx with a subglobular tube. They occur chiefly in tropical America and the West Indies.

Rondo, in music, is the name given to that form of composition in which the main theme, announced at the opening, comes ' round ' again after its place has been taken for a time by other music of an episodical nature. The chief theme should have at least three appearances before there can be any feeling of rondo form in the music.

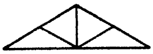
Rönne (rėn′ne), the seaport-capital of the Danish Island of Bornholm, on the west coast; served by rail to Nexö. There are shipbuilding-yards, and manufactures of pottery from locally worked kaolin. Pop. 10,000.

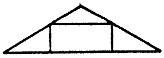
Ronsard (roṇ-sär), Pierre de, French poet, born in 1524, died in 1585. At the age of twelve he became page to the duc d'Orléans; and in 1537 he accompanied James V of Scotland and his bride, Madeleine of France, back to their kingdom. He also spent six months at the English court, and after his return to France in 1540 was employed in a diplomatic capacity in Germany, Piedmont, Flanders, and Scotland. He was compelled, however, by deafness to abandon his diplomatic career; and he devoted himself to literary studies, and became the chief of the band of seven poets afterwards known as the ' Pléiade '. Ronsard's popularity and prosperity during his life were very great. Henry II, Francis II, and Charles IX esteemed him, and the last bestowed several abbacies and priories on the poet. His writings, consisting of sonnets, odes, hymns, eclogues, elegies, satires, and a fragment of an epic poem, *La Françiade*, were read with enthusiastic admiration by his contemporaries both at home and abroad, but the succeeding classic reaction involved them in a contemptuous neglect from which they did not emerge till the second quarter of the nineteenth century. Ronsard combines magnificent language and imagery with a delicate sense of harmony.—BIBLIOGRAPHY: A. Tilley, *Literature of the French Renaissance*; G. Wyndham, *Ronsard and the Pléiade*.

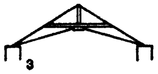
Röntgen (rėnt′gen), Wilhelm Konrad, German physicist, the discoverer of the Röntgen or X-rays, was born in 1845, and died in Feb. 1923. He was appointed in 1876 extraordinary professor of physics in Strasbourg University, and in 1879 ordinary professor of the same subject at Giessen. In 1888 he was appointed to a like position in the University of Würzburg, and in 1899 in the University of Munich. He received the Rumford medal of the Royal Society in 1896, and was awarded the Nobel prize for physics in 1901.

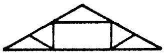
Röntgen Rays. See *Rays, Electric*; *X-ray Spectra*; *Radio-activity*; *Radiology*.

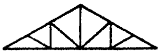
Roof, the covering of any building, irrespective of the materials with which it is constructed. Roofs are of various forms, dependent upon the nature, purpose, and plan of the building. They are usually distinguished by the material used and their mode of construction. The flat roof is the simplest form, and consists of wooden joists laid horizontally, extending from wall to wall. The ' lean-to ' roof is practically a development of the flat roof, the rafters in this case being inclined. The coupled-rafter roof, span 10 to 12 feet, has a double slope, the rafters being inclined towards and meeting upon a horizontal ridge-piece. If a tie beam joins the feet of the rafters, then the roof is designated a couple-close roof, and suitable for a span of 12 to 18 feet. By mounting another tie beam half-way up the rafters they are further strengthened, and the truss is now known as the collar-beam roof truss (fig. 3). Considering spans up to 30 feet, the ' king-post ' truss (fig. 1) may be used. The central post, from which the truss gets its name, sustains the cross beam, with struts projecting from its base supporting the principal rafters. The members are bound together by wrought-iron U-straps with gib and cotter. If, to support the cross beam, two posts are substituted for the king-post, they are known as ' queen-posts ', and the frame a queen-post truss. The composite roof is one in which some of the members are made of timber and some of iron or steel, advantage being taken of the different stress in the various members, timber being used for those under compression, and iron or steel for those in tension. Fig. 3, the German truss, is an example of this type. The framework of iron or steel roofs consists of parts analogous to those already described in the treatment of timber roofs. In construction the principals are usually made of T- or H-section steel bars, and the struts of T-section or angle-iron bars. The smaller ties are usually round rods; the larger ties, flat bars set on edge. A central vertical suspending-rod is termed a 'king-bolt'; lateral vertical suspending-rods are called 'queen-bolts'. Fig. 1 shows the king-bolt truss, while fig. 5 is an improvement of this type, with spans from 20 to 45 feet. Fig. 2 illustrates the queen-rod truss, and figs. 4, 6, 7, 8, and 9 are modifications thereof, with spans of from 30 to 75 feet.

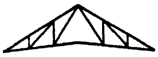

1

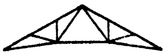

2

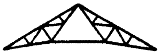

3

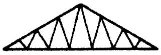

4

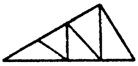

5

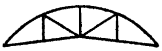

6

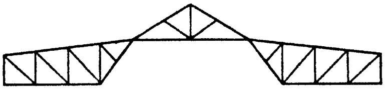

7

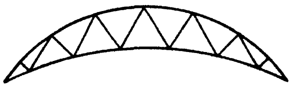

8


9


10


11


12


13

The saw-toothed or northern-light roof is as shown in fig. 10, and is the type commonly used for factories. Fig. 11 is an example of the corrugated iron arched roof, and may be used for spans up to 35 feet. Where very large spans are necessary, such as in station roofs, trusses of the types in figs. 12 and 13 are adopted. The truss in fig. 13 is known as the bowstring truss.

Rook, a bird of the crow family (*Corvus frugilegus*), differing from the crow in not feeding upon carrion, but on insects and grain. It is also specially distinguished by its gregarious habits, and by the fact that the base of the bill is naked, as well as the forehead and upper part of the throat. In Britain and Central Europe the rook is a permanent resident; but in the north and south it is migratory in habits.

Rooke, Sir George, English sailor, born in 1650, died in 1709. He entered the navy at an early age, and rose to be vice-admiral in 1692. His services include the command of the expedition against Cadiz in 1702, the destruction of the French and Spanish fleets in Vigo Bay (1702), and a share in the capture of Gibraltar in July, 1704. In the following August he fought a French fleet of much superior force, under the Comte de Toulouse, off Malaga. The result was indecisive, and this fact was used against Rooke by his political opponents. Sir George quitted the service in disgust in 1705.—Cf. Sir J. K. Laughton, *From Howard to Nelson.*

Roosevelt, Theodore, President of the United States, was born at New York in 1858, died in 1919. Graduating at Harvard, he served as a member of the New York Legislature for three years (1882–4), and in 1884 he became leader of the House. He served for six years as a Civil Service Commissioner, and effected some sweeping reforms. As president of the New York Police Board, he greatly improved the efficiency and *moral* of the force. As Assistant Secretary of the Navy (1897–8) his preparation of the fleet contributed largely to its success against Spain, while he won further distinction by raising and commanding his famous regiment of Rough Riders, which did valuable service in Cuba. In 1898 he became Governor of New York State, and in 1900, against his wish, Vice-President of the United States. On the assassination of M'Kinley, in Sept., 1901, he became President, remaining so till 1908, and distinguishing himself by his strong action against the notorious monopolist trusts. During the negotiations at the end of the Russo-Japanese War (1905) he fought for peace, and was awarded the Nobel prize. During the European War he was in favour of America's intervention on the side of the Allies, and four of his sons went out to the front, one of them being killed. In 1909 he went on a scientific hunting trip in East Africa, and in 1913 explored Brazil. He was an industrious writer, and wrote several books on his travels and adventures, and a few on historical subjects. —Cf. J. A. Riis, *Theodore Roosevelt: the Man and the Citizen.*

Roosevelt, Rio, a river of Brazil, a tributary of the Madeira, which it flows northwards to join in 50° 20′ s. lat.; length, 940 miles.

Root, that portion of a vascular plant which enters, and fixes itself in, the ground, and serves to absorb water and dissolved salts from the soil. It differs from the stem in bearing no leaves, in being normally devoid of chlorophyll, and in other less obvious features. Often there is a main or tap root, derived from the radicle of the embryo, bearing a number of endogenously produced branches or lateral roots, which in their turn bear smaller rootlets. In other cases (e.g. grasses), the main root is short-lived, being soon replaced by a tuft of thin ‘fibrous’ roots. ‘Adventitious’ roots arise secondarily from the stem, and may serve the ordinary purposes of roots, or, on the other hand, act as buttresses (e.g. screw-pine, Rhizophora) or as climbing organs (ivy). The younger parts of the root-system bear innumerable root-hairs, delicate tubular outgrowths from the superficial cells (piliferous layer), which are the principal organs of absorption; the older portions are covered with cork or bark, and are thus incapable of absorbing liquids. Many roots also serve for storage of reserve materials, as those of carrot, parsnip, beetroot, dahlia, pilewort, &c.

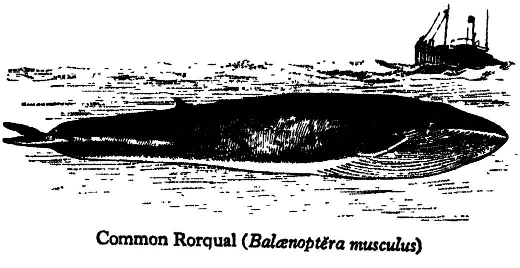
Rope and Rope-making. The term rope is applied to cordage when the finished product has a circumference of 1 inch or more. Fibrous ropes are extensively made of hemp, flax, jute, cotton, coir, manila, sisal, and similar vegetable fibres, while metallic ropes are made by the combination of a considerable number of fine steel, copper, or other wires. In nearly all cases the fibrous ropes are made by twisting, in various ways, a large number of ordinary sized yarns spun for the purpose. The required number of these yarns is twisted together to form what is termed a *strand*, and then three or more of these strands are twisted or *laid* to complete the rope. Large bobbins or spools of yarn are placed in a huge frame, termed a bank, and the ends of all these yarns passed individually through a large number of holes in a *register plate*, and then through a tapered tube. The ends of all the yarns are then fixed to a rotating hook of the *traveller*, which moves on rails in the rope-walk. As the traveller moves from the stationary register plate, it draws the yarns from the bobbins or spools and through the holes of the register plate, and simultaneously the rotating hook of the traveller imparts the necessary amount of twist to the group of yarns. The length of the strand, if made in a rope-walk, is limited to the length of the walk, and when the desired length of strand has been made, it is taken off the hook of the traveller, and the twisted strand attached to a peg, post, or other support. It is supported also at intervals by vertical supports to keep it off the ground, and when the ends near the register plate have been cut, that end of the strand is similarly fastened to a suitable post or support. Several such strands may be made, cut off as already explained, and also tied and supported by the same posts and vertical supports. When the supporting apparatus is full of strands, the process of laying the strands to form ropes commences. The complete rope often comprises three strands or four strands. Hence, for a three-strand rope, three of those already made are detached from the posts, and placed in position for being compounded. Thus the three strands are attached at one end to three hooks of the traveller, and at the other end to three hooks of a stationary machine; extra twist is imparted by rotating the hooks. All three strands are then attached to one hook at the traveller, the strands disposed in the tapered grooves of the *top* of a *top-cart*, the traveller braked in order to keep the rope at the desired tension, and then the *laying* of the three strands is commenced. The top-cart is moved towards the stationary machine as the laying is performed, and meanwhile the traveller is drawn forwards a distance in proportion as shrinkage or contraction takes place, due to the laying of the three strands. Four such strands may be combined, and a *core* or *central strand* united with the four proper strands. Sometimes the strands are tarred before they are laid. Exceedingly long walks are required when the strands are made and laid by the above processes. To eliminate this drawback, similar ropes are made entirely by machinery termed *house machines*; this title is to distinguish the machinery from that employed in the rope-walks. After a process of hackling or carding, drawing, roving, and spinning, in the case of hemp, flax, jute, or cotton, or processes in special preparing machines and automatic spinning-machinery for manila and the like, the foundations of the ropes are made. When the yarns are fine, they are wound on to large bobbins or spools as before, and placed in a similar bank situated near the first actual machine in the process, which is termed a *stranding-machine*. This machine is provided with a register plate, through the holes of which the ends of the yarns from the bobbins or spools are threaded. In this machine, however, the strand is made by twisting the group of threads, and simultaneously the completed strand is wound, as it is being twisted, upon a huge bobbin; the strand is guided on to this bobbin so as to form layer upon layer on the barrel, each layer extending the distance between the two steel flanges of the bobbin. Then these large bobbins with their complement of strand are put into a *laying-* or *forming-machine* in order to insert more twist, and to combine or twist the strands into rope form. Three or four strands, the latter with or without a central core, can be manipulated in these machines. The rope-machines (laying or forming) are both of the horizontal and vertical type. In both cases the large strand bobbins are rotated by machinery, and the twisted strands drawn from the bobbins mechanically as the rope is formed and simultaneously wound into a coil. If the rope is very thick, special heavy coiling-machines are essential to prepare the ropes for dispatch. Other machines are constructed to carry and to rotate a comparatively large number of bobbins, and to perform the stranding, forming, and coiling processes simultaneously. Finished ropes are distinguished by special names, according to the number of strands of which they are composed and according to the disposition of the strands. The yarn for the strands is twisted to the right; these yarns, when compounded to form a strand, are reversed, that is, twisted to the left; and in each succeeding operation of combining strands or ropes the twist is reversed, since this reversal each time helps to parallelize the individual fibres and to minimize contraction and the tendency to kink. Three left-hand twisted strands are twisted to the right to form a *hawser-laid* rope. Three *hawser-laid* ropes twisted to the left form a *cable-laid* rope. A *shroud-laid* rope consists of four strands, and, as already stated, it may also have a core. Square ropes are also made by stitching together four, nine, or sixteen circular ropes. Wire ropes are now used in the rigging of ships, as well as for cables for electrical and other purposes. Coir ropes, which are not so strong as those made from hemp, &c., are used in ships, as they are not much injured by salt water.

Roquefort (rok-fōr), a village of Southern France, in the department of Aveyron. It is famous for its production of a kind of cheese made from the milk of goats and sheep. Pop. 1000.

Roraima (ro-rȧ-ē′mȧ), a mountain of South America, where the boundaries of British Guiana, Venezuela, and Brazil meet, and several tributary rivers of the Amazon and Orinoco have their source. Height, 8600 feet.

Rorke's Drift, a ford in South Africa, on the Buffalo River, a tributary of the Tugela, some 20 miles south-east of Dundee, the scene of a gallant defence on the night of 22nd Jan., 1879, on the part of a handful of British troops against 4000 Zulus, who were successfully kept at bay from behind extemporized ramparts.

Rorqual, or **Fin-whale**, the name given to certain whales, allied to the common or whalebone whales, but distinguished by having a dorsal fin, with the throat and under parts wrinkled with deep longitudinal folds. Several species are known, but they are rather avoided on account of their ferocity, the shortness and coarseness of their baleen or whalebone, and the small quantity of oil they produce. The northern rorqual or blue whale (*Balænoptĕra sibbaldii*) attains a great size, being found up to 85 feet, and is thus the largest living animal known. The common rorqual (*B. musculus*) averages 60 to 65 feet in length, and the lesser rorqual (*B. rostrata*) 25 to 30 feet.



Common Rorqual (*Balænoptĕra musculus*)

Rosa, Salvator, Italian painter, etcher, and poet, born near Naples in 1615, died in 1673. Rosa's father, dying in 1632, left his family in difficulties, and Salvator was compelled to sell his landscapes for small sums. One of his pictures fell into the hands of the painter Lanfranco, who at once recognized the genius of the youth, and encouraged him to go to Rome, where he soon established his reputation and rose to fame and wealth. The bitterness of his satire, expressed both in his satirical poems and in an allegorical painting of the *Wheel of Fortune*, rendered his stay in Rome inadvisable. He therefore accepted an invitation to Florence (1642), where he remained nearly nine years, under the protection of the Medici. He finally returned to Rome, where he died. Salvator Rosa delighted in romantic landscape, delineating scenes of gloomy grandeur and bold magnificence. He also painted battle-scenes and historical pictures. His poems were all satires. Rosa etched from his own works with great skill.—Cf. Lady Morgan, *Life and Times of Salvator Rosa.*

Rosa, Monte, a mountain or group of the Pennine Alps, lies on the frontiers of the Swiss canton of Valais and Piedmont, and forms part of the watershed between the Rhone and the Po. Next to Mont Blanc it is the highest mountain in the Alps, but as a group it is much more massive than the Mont Blanc group. It has eight summits above 14,000 feet, the highest being Dufourspitze (15,217), ascended for the first time in 1855. Of the huge glaciers that occupy the slopes of this mountain the chief are the Görner Glacier on the west, the Schwarzberg and Findelen Glaciers on the north, the Sesia and Macugnaga Glaciers on the east, and the Lys Glacier on the south. See *Alps*.

Rosa′cea, or **Acne Rosacea**, is a chronic affection of the middle part of the face, involving also the forehead and chin. It is characterized by marked redness, dilatation of the capillaries, and the formation of pustules. It is much more frequent among women than men, and is usually seen in late middle life. The chief cause is derangement of the digestive tract, and many of the patients suffer from chronic dyspepsia and constipation. In treatment the most important thing is to discover the cause of the digestive derangement, and correction of this usually relieves the symptoms. The diet should be very simple, all alcohol avoided, and only a limited amount of hot drinks, especially tea and coffee, taken.

Rosa'ceæ, a large and important order of polypetalous dicotyledons, of which the rose is the type, having distinct, separate carpels, numerous perigynous stamens, and alternate leaves. The species, including herbs, shrubs, and trees, are for the most part inhabitants of the cooler parts of the world. Scarcely any are annuals. The apple, pear, plum, cherry, peach, almond, nectarine, apricot, strawberry, raspberry, and similar fruits are the produce of trees and plants of this order. Some of the species are also important as medicinal plants. The genera of the order are divided by Viner into six tribes, viz. Roseæ, Spiræceæ, Amygdaleæ, Sanguisorbeæ, Dryadeæ, and Pomeæ.

Rosamond, commonly called Fair Rosamond, the mistress of Henry II of England, was the daughter of Walter de Clifford, a knight of property in various shires. She died in 1176 or 1177, and was buried in the church of Godstow Nunnery, whence, however, Hugh of Lincoln caused her body to be removed in 1191. The fable of the dagger and poison with which the jealous Queen Eleanor is said to have sought out her rival has not been traced farther back than a ballad of 1611.

Rosan'iline. Commercial *rosaniline*, or *fuchsine*, or *magenta*, is the chloride or acetate of the colourless base triamino-diphenyl-tolyl-carbinol. These salts form green metallic-looking crystals, which dissolve in water, forming a deep-red solution. They dye silk, wool, and cotton a bright magenta colour. The dye is prepared by oxidizing aniline and toluidine by means of nitrobenzene. Many dyes are known which are derivatives of rosaniline and pararosaniline.

Rosa'rio, a city and river-port of the Argentine Republic, capital of the province of Santa Fé, on the right bank of the Paraná. It was made a port of entry in 1854, and is now the second city of the Republic. It has communication by rail and river with Buenos Ayres, and also by railway with the interior provinces. It contains foundries, brickworks, jam-factories, breweries, tanneries, soapworks, timber- and flour-mills, &c., but its commerce is of greater importance than its manufactures. Pop. 250,000.

Ro'sary, among Roman Catholics the recitation of the Ave Maria and the Lord's Prayer a certain number of times. The name is also commonly given to the string of beads by means of which the prayers are counted. The complete or Dominican rosary consists of 150 small beads for the Aves, divided into groups of 10 by 15 large beads for the Paternosters. The ordinary rosary has only 50 small beads and 5 large beads; but if repeated thrice makes up the full rosary. A doxology is said after every tenth Ave. The use of rosaries was probably introduced by the Crusaders from the East.

Roscius, Quintus, the greatest comedian of ancient Rome, born a slave about 134 B.C. He realized an enormous fortune, and was raised to the equestrian rank by Sulla. He enjoyed the friendship of Cicero, who defended his friend in a law suit (*Pro Q. Roscio Comœdo*). Roscius died about 62 B.C.

Roscoe (ros'kō), Sir Henry Enfield, British chemist, born in London, 1833, died 1918. He was educated at Liverpool High School, University College, London, and Heidelberg. From 1858 to 1886 he was professor of chemistry at Owens College, Manchester. He was vice-chancellor of London University from 1896 to 1902. His works include *Lessons in Elementary Chemistry*; *Lectures on Spectrum Analysis*; and, with Professor Schorlemmer, a *Treatise upon Chemistry*.

Roscoe, William, English historian and miscellaneous writer, born in 1753, died in 1831. He retired from his business of attorney in 1796, and became a partner in a bank, which failed in 1820. In 1806–7 he represented Liverpool in Parliament. In 1796 his great work, *Life of Lorenzo de' Medici*, was published, and at once gained him a high reputation. Another important work, the *Life and Pontificate of Leo X*, followed in 1805.

Roscom'mon, an inland county of Ireland, in the east of the province of Connaught; area, 990 sq. miles. The surface is undulating or flat, except in the north. The Shannon bounds most of the county in the east, and the Suck on the north-west. The chief of the numerous lakes is Lough Ree, an expansion of the Shannon. Roscommon contains iron and coal, but limestone is also worked. Many districts are highly fertile, and the pastures are among the best in Ireland. The chief crops are oats and potatoes. The chief towns are Roscommon, Boyle, and Castlereagh. Pop. 94,000.

Roscommon, the county town of Roscommon county, Connaught, Ireland; served by the Midland Great Western Railway. It contains the ruins of an abbey founded in 1257, and of a fine castle of about the same date. Pop. 2000.

Roscrea (ros-krā'), a market town of Ireland, in the county of Tipperary, on the Little Brosna River; served by the Great Southern & Western Railway. Pop. 2000.

Rose, the flower which has given name to the large nat. ord. Rosaceæ, seems to be confined to the cooler parts of the northern hemisphere. The species are prickly shrubs, with pinnate leaves, provided with stipules at their base; the calyx contracts towards the top, where it divides into five lanceolate segments; the corolla has five petals, and the stamens are numerous; the seeds are numerous, covered with a sort of down, and are attached to the interior of the tube of the calyx, which, after flowering, takes the form of a fleshy globular or ovoid berry. There are about twenty species of rose natives of Britain, common examples being the dog-rose (*Rosa canīna*), Scotch rose (*R. spinosissima*), sweet-brier or eglantine (*R. rubiginōsa*), &c. In the natural state the flowers are single, but double varieties, such as the damask rose (*R. damascēna*), Provence rose (*R. centifolia*), and musk-rose (*R. moschāta*), were introduced into Britain 300 years ago. Several thousand varieties of rose are now recorded. In some countries roses are extensively cultivated for the manufacture of rose-water, attar of roses, &c.

Rose Acacia (*Robinia hispida*, nat. ord. Leguminosæ), a highly ornamental flowering shrub inhabiting the southern parts of the Alleghany Mountains, and now frequently seen in gardens in Europe. It is a species of locust (q.v.).

Rose-apple, or **Malabar Plum** (*Eugenia Jambos*), nat. ord. Myrtaceæ, an East Indian tree. The fruit is about the size of a hen's egg, is rose-scented, and has the flavour of an apricot.

Rose-bay, the name of several plants; as the *Nerium Oleander*; the *dwarf rose-bay*, a plant of the genus Rhododendron; and *Epilobium angustifolium*, or French willow.

Rosebery, Archibald Philip Primrose, Earl of, and of Midlothian (1911), born in 1847, was educated at Eton and Christ Church, Oxford, and succeeded his grandfather in 1868. He was Under-Secretary at the Home Office from 1881 to 1883, and Lord Privy Seal and First Commissioner of Works in 1885. When the introduction of the Home Rule Bill split the Liberal party, he adhered to Gladstone, and next year held the Secretaryship of Foreign Affairs till the fall of the Gladstone Government. He was twice chairman of the London County Council. From 1892 to 1894 he was Secretary for Foreign Affairs under Gladstone, and in 1894–5 he was himself Prime Minister. He resigned the Liberal leadership in 1896. At times, as when he denounced the Budget of 1909, it seemed as if he would return to active participation in political work, but after the constitutional crisis of 1910–1 he took no further part in public life until the European War, when he promoted recruiting in his capacity of Lord-Lieutenant of Midlothian and Linlithgowshire. He is the author of monographs on Pitt, Napoleon, Cromwell, Sir Robert Peel, and Lord Randolph Churchill, and his *Miscellanies, Literary and Historical* appeared during 1921. He was created a Knight of the Garter in 1892. In 1878 he married Hannah, daughter of Baron Meyer de Rothschild, but lost his wife in 1890. His younger son, Neil Primrose, after a career of much promise, was killed in Palestine in 1917 at the age of thirty-five.

Rose-chafer, or **Rose-beetle** (*Cetonia aurata*), a beetle included in the tribe of Lamellicornia, which frequents roses, feeding on the petals, stamens, and pollen.

Rosemary (*Rosmarīnus officinālis*), a shrubby aromatic plant (nat. ord. Labiatæ), a native of Southern Europe. It has but two stamens, dark-green leaves, white underneath, and pale-blue flowers. It yields, by distillation, the aromatic perfume oil of rosemary.

Rose-noble, an English gold coin of the value of 10*s*., first struck by Edward IV in 1465, and so called to distinguish it from the old nobles (worth 6*s*. 8*d*.), and because it was stamped on one side with the figure of a rose.

Rose of Jericho (*Anastatica hierochuntica*), a small cruciferous plant, growing in the arid wastes of Arabia and Palestine. When it is ripe its leaves drop, and it becomes rolled up like a ball in the dry season, but opens its branches and seed-vessels when it comes in contact with moisture.

Rose of Sharon, a name given to one of the St. John's-worts, *Hypericum calycinum*, a dwarf shrub with trailing underground stems and showy yellow flowers. It is a native of South-Eastern Europe, but is naturalized in Britain. The Rose of Sharon of the Old Testament seems to have been a narcissus.

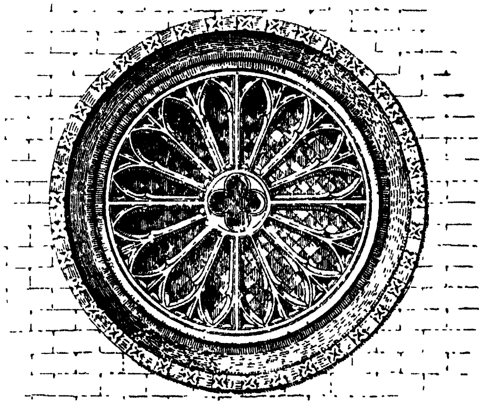
Rose′ola is a rose-coloured efflorescence or rash on the skin. The term is applied to various eruptions associated with different infective diseases, as *roseola cholerica*, an eruption seen in cholera; *syphilitica*, the bright-pink spots which are the first skin signs of syphilis; *R. typhosa* in typhoid fever; and *R. vaccinia* following vaccination.

Roses, Wars of the. The immediate causes of the Civil War in England in the fifteenth century, which came to be known from the badges of the two parties as the Wars of the Roses, were the failure of English policy in France after the death of Henry V, the breakdown of administration at home under his weak but saintly successor, Henry VI, and the unpopularity of Henry's wife, Margaret of Anjou. The title of the House of Lancaster to the throne was disputable, and that of the House of York was, on the strict theory of primogeniture, better founded. The marriage of Henry VI was childless for some years, and the Duke of York regarded himself as the destined successor until the birth of a Prince of Wales in 1454. The king had recurrent attacks of insanity, and the queen relied upon the advice of the Duke of Somerset, against whom York took up arms, gaining a victory at St. Albans in May, 1455 (the first battle of the Wars of the Roses). York did not claim the crown, but was content with becoming the chief minister. Margaret was unwise enough to replace him, and the Civil War began in 1459. York had to go into hiding, but his ally Richard Neville, Earl of Warwick, defeated the Lancastrians (the Red Rose) at Northampton in July, 1460, and York returned and obtained from Parliament a promise of his succession to the crown. Margaret could not acquiesce in the disinheritance of her son, Prince Edward, and, at Wakefield, in Dec., 1460, she defeated the Yorkists. The Duke of York was slain, but his son Edward succeeded to his title and claims. The queen marched her victorious army on London, and won the second battle of St. Albans in Feb., 1461, but King Henry would not allow her to lead her wild northern levies to sack the capital, and this decision proved the ruin of the Lancastrian cause. Edward of York entered London, and was greeted by the citizens as king, and in March he won a decisive victory over the Lancastrians at Towton. The triumph of the White Rose was not yet secure. Edward IV quarrelled with Warwick, who, in 1470, went to France and was reconciled to Queen Margaret. He invaded England, and Edward fled to Burgundy, while Warwick released Henry VI from the Tower and restored him to the throne. In March, 1471, Edward landed in Yorkshire, defeated Warwick at Barnet, where the great 'King Maker' was killed, and subsequently defeated Queen Margaret at Tewkesbury. She was captured, and her son fell on the field. The Lancastrians did not have another opportunity until the reign of Richard III, the brother of Edward IV, who ascended the throne through the murder of his nephews, Edward V and the Duke of York (1483). The nearest Lancastrian heir, Henry Tudor, Earl of Richmond, obtained French help, and defeated and killed Richard III at Bosworth in Aug., 1485. The battle of Bosworth, and the accession of Henry VII and his marriage to the heiress of Edward IV, are generally regarded as the end of the Wars of the Roses, but the Yorkists were responsible for the rebellions of the two pretenders, Lambert Simnel and Perkin Warbeck, and it may be argued that the end did not come until the capture of Warbeck in 1497.—Bibliography: J. Gairdner, *The Houses of Lancaster and York*; Sir J. H. Ramsay, *Lancaster and York*; Sir C. W. C. Oman, *Warwick the King Maker*.

Roset'ta (Egy. *Reshîd*, the ancient *Bolbitine*), a city of Egypt, near the mouth of the Rosetta branch of the Nile, 30 miles west of Alexandria. Its trade, once considerable, has now been almost entirely diverted to Alexandria. Pop. 17,000.

Rosetta-stone, a tablet of black basalt, bearing an inscription in three versions (hieroglyphic, demotic, and Greek) in honour of Ptolemy Epiphanes and belonging to about 196 B.C. It furnished the key for the deciphering of the hieroglyphic inscriptions. Found by Boussard, a French officer, in 1799, near Rosetta, it was acquired by Great Britain in 1801, and brought to the British Museum in 1802. See *Hieroglyphics*.—Cf. S. Sharpe, *Rosetta Stone in Hieroglyphics and Greek*.

Rose-window, a circular window, divided into compartments by mullions and tracery radiating from a centre; also called Catharine-wheel, and marigold-window. It forms a fine feature in the church architecture of the thirteenth and fourteenth centuries. In France it is much used; some examples, as that at Rheims Cathedral, are over 40 feet in diameter.



Rose-window. Fourteenth Century

Rosewood, the wood of *Dalbergia nigra* and other leguminous trees, so named because some kinds of it when freshly cut have a faint smell of roses. Most rosewood comes from Brazil, but it is also found in Honduras and Jamaica. The French *Bois de Rose* (the German *Rosenholz*) is called tulip-wood in English.

Rosicrucians (Lat. *rosa*, rose; *crux*, cross), the name of a secret society, of which little is known. The aim of the Rosicrucians, or Brethren of the Rosy Cross, was said to be the improvement of humanity by the discovery of the 'true philosophy', and they claimed a deep knowledge of mysteries of nature, such as transmutation of metals, and means for prolonging life. According to Andreä, a Lutheran clergyman who wrote early in the seventeenth century, the society was founded in the fifteenth century by a German baron named Rosenkreuz (i.e. 'rosy cross'), who had spent a large portion of his days among the Brahmans, and in Jerusalem, Damascus, Egypt, Morocco, and Fez, in the pursuit of wisdom.

Whatever may have been the secret of the Rosicrucians, it has been well kept. The popular impression that such societies did exist gave rise, however, to a number of associations that spread over Europe, and, owing to the general ignorance of their principles and objects, they have become in one way or other connected in public opinion with the Freemasons, Cabalists, Illuminati, &c. The charlatan Cagliostro professed to be a Rosicrucian. One of the most exhaustive works on Rosicrucianism is that of Buhle, entitled *Ueber den Ursprung und die vornehmsten Schicksale der Orden der Rosenkreuzer und Freimaurer* (Göttingen, 1803), in which the author attempts to demonstrate that the Rosicrucians were the originals of the Freemasons, and that "Freemasonry is neither more nor less than Rosicrucianism as modified by those who transplanted it into England". In 1866 the Societas Rosicruciana in Anglia was founded by R. W. Little, and publishes *Transactions*.—BIBLIOGRAPHY: C. W. Heckethorn, *The Secret Societies of all Ages and Countries*; W. Wynn Westcott, *The Rosicrucians: their History and Aims*; J. Yarker, *The Arcane Schools.*

Roslin, or **Rosslyn**, a small village in the county of Midlothian, Scotland, about 7 miles south of Edinburgh, on the North Esk. It is interesting chiefly for its ruined castle and chapel. Roslin Castle was the ancient seat of the St. Clairs or Sinclairs. The present buildings were mostly erected since the burning of the castle by the Earl of Hertford in 1554. Roslin Chapel was built in 1450 by Sir William St. Clair, and is a Gothic structure forming the chancel and part of a transept of a church. The interior is richly adorned with carving, including the celebrated 'prentice pillar'. Pop. 2000.

Rosmi'ni-Serba'ti, Antonio, Italian philosopher, born 1797, died 1855. He is regarded as the founder of modern Idealism in Italy. The chief points of his system are fully treated in his *New Essay on the Origin of Ideas*, translated into English, 1883.—Cf. W. Lockhart, *Life of Rosmini.*

Ross, Sir James Clark, British explorer, born in London in 1800, died in 1862. He entered the British navy at the age of twelve, made many Arctic voyages, and in 1831 discovered the north magnetic pole. He commanded the expedition in the *Erebus* and *Terror* to the Antarctic Ocean in 1839–43, and in 1848 he made a voyage in the *Enterprise* to Baffin Bay in search of Sir John Franklin.

Ross, Sir John, British explorer, born in 1777, died in 1856, He entered the navy in 1786. In 1817 he accepted the command of an Admiralty expedition to search for a north-west passage, and in April, 1818, set sail in the *Isabella*, accompanied by Lieutenant Parry in the *Alexander*. His next expedition, in the steamer *Victory*, set out in May, 1829. Ross entered Prince Regent's Inlet, and discovered and named Boothia Felix and King William's Land. In 1832 he was forced to abandon his ships, and he and his crew suffered great hardships before they were picked up in Aug., 1833, by his old ship the *Isabella*. In 1850 he made a last Arctic voyage in the *Felix*, in a vain endeavour to ascertain the fate of Sir John Franklin.

Ross, Sir Ronald, British physician, born 13th May, 1857. From St. Bartholomew's, London, he entered the Indian Medical Service (1881), and devoted himself to tropical medicine, especially the study of malaria, discovering the life-history of malaria parasites in mosquitoes (1897–8), and leading an expedition to West Africa (1899), where malaria-bearing mosquitoes were found. In 1895 he was awarded Parke's gold medal, and in 1902 the Nobel prize for medicine. He has held many important posts, and has received many decorations and honours. His publications include: *The Revels of Orsera* (a novel); *The Prevention of Malaria*; *Philosophies* and other poems: and many mathematical and professional papers.

Ross, an urban district of Herefordshire, England, on the Wye. It is associated with the memory of the philanthropist John Kyrle (died 1724), Pope's 'Man of Ross', who is buried in a church there. Pop. 4800.

Ross and Cromarty, formerly two separate counties of Scotland, united into one in 1889. The latter consisted merely of detached portions scattered over the former. The county extends across the breadth of Scotland, and includes part of the Island of Lewis and other islands. Area of the whole, 3089 sq. miles. The west coast is bold and rugged, and deeply indented with bays and inlets (Lochs Alsh, Carron, Torridon, Ewe, Gruinard, Broom, and Gairloch). The principal inlets on the east coast are Beauly Loch and Firth, and Cromarty and Dornoch Firths. The peninsula lying between Cromarty Firth and Beauly Loch and Firth is called the Black Isle. A great portion of Ross and Cromarty consists of irregular masses of lofty rugged mountains (Carn Eige, 3877 feet). Pasture of excellent quality abounds in the west, while good agricultural lands extend along the Firths of Moray, Cromarty, and Dornoch. Sheep farming and grazing are extensively carried on. There are no rivers of any size, but there are several fine freshwater lochs, the principal of which is Loch Maree, about 12 miles long by 2 miles broad. The united county returns a member to Parliament. Principal towns: Dingwall (the county town), Stornoway, Cromarty, Invergordon, Tain, Fortrose, and Strathpeffer. Pop. (1921), 70,790.

Rossa'no, a walled city of Calabria, South Italy, in the province of Cosenza, 3 miles south of the Gulf of Taranto. In the neighbourhood are quarries of alabaster and marble. Pop. 10,000.

Rossetti, Gabriel Charles Dante, better known as Dante Gabriel, painter and poet, born in London in 1828, died there in 1882. Son of Gabriele Rossetti, Italian professor at King's College, London, he first studied desultorily at Cass's, then for a short time at the Royal Academy Schools, and finally became pupil of Ford Madox Brown. With Millais and Holman Hunt he founded in 1848 the Pre-Raphaelite Brotherhood (q.v.). His poems and pictures alike reflect a spirit of mediæval mysticism and a sensuous imaginative outlook, which often find incomplete expression in his painting, owing to technical weaknesses, especially in draughtsmanship. Among his most important paintings are: *The Childhood of Mary*, *The Annunciation*, *Beata Beatrix*, *Monna Vanna*, *Dante's Dream*; and many water-colours and portraits. His chief poems are *The House of Life*, a series of 101 sonnets; and *The King's Tragedy*. His sister, Christina Georgina (1830–94) was a distinguished poet, and his brother, William Michael (1829–1919), achieved distinction as a writer.—BIBLIOGRAPHY: W. M. Rossetti, *Dante G. Rossetti as Designer and Writer*; Ruskin, *Rossetti*, *Pre-Raphaelitism*; H. C. Marillier, *Dante Gabriel Rossetti: Memorial of his Art and Life*; A. C. Benson, *Rossetti* (English Men of Letters Series).

Rossi'ni, Gioacchino Antonio, Italian composer, born at Pesaro in 1792, died in 1868. His father was town-trumpeter, and his mother, for a time, a singer in *opera buffa*. The young Rossini spent his early years under rather unsettled conditions owing to political and domestic troubles, and his education, both general and musical, was somewhat haphazard.

After some earlier essays in composition he wrote *La Cambiale di Matrimonio* (The Marriage Market), which was produced at Venice with much success. The first of his works, however, to bring him an international fame was *The Barber of Seville*, a comic opera which first appeared in 1816 at Rome in carnival time, and quickly spread to nearly all the opera-houses of Europe. It is still a favourite, being almost the only Italian opera of its period that has remained in the operatic repertoire. Others of his more famous operas were: *Tancredi* (1813), over which the Venetians went mad with delight; *Otello* (1816); *La Gazza Ladra* (1817); *Mosé in Egitto* (1818); *Semiramide* (1823); and *William Tell* (1829). The last-named opera is generally regarded as Rossini's greatest work on account of its maturity and comparative freedom from the musical conventions of the day. It is still performed, but not so frequently as *The Barber of Seville*.—BIBLIOGRAPHY: H. S. Edwards, *Rossini and his School*; L. Dauriac, *Rossini*.

Ross Sea, an arm of the Antarctic Ocean, extending between King Edward VII Land and Queen Victoria Land. The Ross Ice Barrier blocks it to the south. During the summer it is comparatively ice-free, and forms a convenient starting-point for South Polar exploration.

Rostand, Edmond, French poet, dramatist, and man of letters, born in Marseilles, 1868, died 1918. He early went to Paris, where he wrote plays and poems without, however, at first attracting much notice. In *La Samaritaine* (1897) Rostand appears as a mystic and a pre-Raphaelite, inspired by Maeterlinck, Tolstoy, Verlaine, and Rossetti. He obtained a brilliant success with his play *Cyrano de Bergerac*, which was soon played all over the world. His other plays are *Les Romanesques* (1894), *La Princesse lointaine* (1896), *L'Aiglon* (1900), and *Chantecler* (1910), in which last Rostand appeared as an interpreter of life. He was elected a member of the French Academy in 1901.

Rostock, the largest town of Mecklenburg-Schwerin, Germany, on the navigable Warnow. A few relics of the picturesque mediæval town survived the great fire of 1677, and are still extant. The town has some remarkable buildings, and a university (founded 1419). Rostock, with the out-port of Warnemünde, carries on a fairly active trade in cattle, horses, cereals, cloth, and linen, and has brewing, linen manufacturing, and other industries. Pop. 65,000.

Rostov', a town of Russia, in the government of Yaroslav, on Lake Nero. It is one of the oldest towns in Russia, being mentioned by Nestor the Chronicler in 863, and has a cathedral and a kremlin. Pop. 18,000.

Rostov, or **Rostof-on-the-Don**, a town of Southern Russia, in the province of the Don Cossacks. Its importance is due to the agricultural development of South Russia, which has raised it in about a century from a mere village to a large town with important fairs, an extensive grain-shipping industry, trade in wool, oil, tallow, ores, pitch, and manufactures of tobacco. Rostov is the centre of three railway systems. Pop. 200,000.

Rosyth, a British naval base of Fife, Scotland, in the Firth of Forth, designed for the concentration of the North Sea Fleet, and regarded, until the outbreak of the European War, as the principal base of the Grand Fleet. During the war, however, Admiral Jellicoe preferred to establish himself at Scapa Flow, and Rosyth became a secondary base, used chiefly by the battle-cruiser squadrons, although, on the establishment of a boom across the Forth, a percentage of the Battle Fleet was frequently at anchor within it. In 1903 the Admiralty decided to acquire Rosyth. Work was completed in 1916, and 78 capital ships and 119 smaller craft were docked and refitted between that date and the signing of the Armistice. The town belongs to the burgh of Dunfermline, and is divided into Garden City and Tin Town. Pop. 9000.

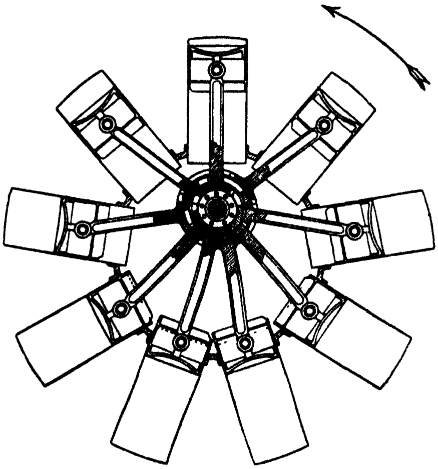
The original scheme made no provision for the erection of a gigantic dockyard system at Rosyth. Warships were to anchor in the fairway, and were to be brought into touch with the great repair-yards of the Clyde by means of a trans-Scottish ship canal via the existing canal from Grangemouth, Stirling, Loch Lomond, Balloch, and Dumbarton. This canal was also to be open for mercantile traffic. The scheme was reviewed during the European War, but it was found that the construction would be far too lengthy a process, and great dockyards were constructed forthwith at Rosyth.

Rota Roma′na, the highest ecclesiastical court of appeal for all Christendom during the supremacy of the Popes. The tribunal can be traced back to the thirteenth century, but with the dwindling temporal power of the Popes it gradually lost all authority in foreign countries.

Rotary Clubs. The first Rotary Club was formed (1909) in Chicago, United States, by Paul P. Harris, a lawyer of Scottish birth. The scheme of its founder was to get together a circle of professional and business men who would meet at short intervals for mutual improvement, general good-fellowship, and the exchange of useful and practical information. The fact that the original Rotarians visited in turn each other's business houses to acquire information led to the name of the society and to the form of its badge of membership, a small toothed wheel. The motto, ‘ Service, not Self ’, with the added axiom ‘ he profits most who serves best ’, further indicates the prominent social aims of the body. Rotarianism rapidly achieved great popularity in the United States, and later spread to Great Britain, where eight ‘ founder ’ clubs were established in 1914. A prominent feature of the movement is the weekly luncheon, at which a brief address is given to the members present by some local man who can impart useful information on a subject of general, or especially commercial, interest. British Rotarians are members of the Rotary International Association of Great Britain and Ireland, whose mouthpiece is *The Rotary Wheel.* There are eight District Councils, with about one hundred rotary clubs, throughout the British Isles. In 1921 a great gathering of Rotarians from all quarters of the world was held in Edinburgh, more than twenty-five nationalities being represented by the delegates.

Rotary Engine. From the earliest days of the use of engines in the generation of power, attempts have been made to design engines which would give immediate rotary motion without the first production of straight-line motion, but the results have not, so far, justified the efforts. It is recognized that little advantage can be obtained by the use of this type of engine if the speeds of running required are not very high. In the development of the steam turbine (see *Turbines, Steam*), a useful solution has been obtained.

Petrol engines in which the crankshaft is fixed and the cylinders rotate have been proposed for air-craft, but although they were very popular at one period in the development of aviation, their use is now diminishing because of the great improvements which have been made in the ordinary type of engine. The pistons, usually nine in number, are provided with connecting-rods with ‘ shoes ’ fitted to them in place of the usual ‘ big ends ’. These shoes are held in grooves on the thrust block, which is capable of rotation on the fixed crank pin. As the cylinders revolve the pistons move out and in because the crank pin is not set at their centre of rotation.



Rotary Engine

Rotation of Crops, in agriculture and horticulture, the practice of growing a series of different plants on the same area, instead of cultivating the same kind year after year. The following are the chief advantages derived: (1) By alternating shallow-rooted crops, such as barley, with deep-rooted crops, such as mangel wurzel, use is made of the plant food contained at different levels in the soil. (2) The food requirements of plants vary considerably. Root-crops need a large amount of nitrogen, while cereals require far less potash than red clover and turnips. Thus rotation economizes manure. (3) Rotation checks many fungoid and insect pests. Land kept continually under clover, for example, becomes ‘ clover sick ’. (4) The plant residues left in the ground by a particular crop are of greater use to some other kind of crop. Leguminous plants increase the amount of nitrogen in the soil, and thus save the cost of nitrogenous manures. (5) Rotation economizes labour by spreading it over the year. Land under root-crops can be cleaned while under cultivation. (6) Rotation provides crops maturing at different times, and renders the maintenance of stock economically possible. This is one of the great advantages of ‘ mixed farming ’. The most important British rotation is the Norfolk or four-course: roots, barley, clover, wheat. This may be modified into a five-course: roots, wheat, barley, seeds, oats or wheat. There may also be six, seven, or even eight courses. Sometimes ‘ catch crops ’ are grown in intervals between ordinary crops of a series.

Rotche, Sea-dove, or **Little Auk** (*Mergŭlus alle*), an aquatic Arctic bird belonging to the family of auks or Alcidæ, about the size of a large pigeon. Its plumage is black on the back and wings, white on the breast.

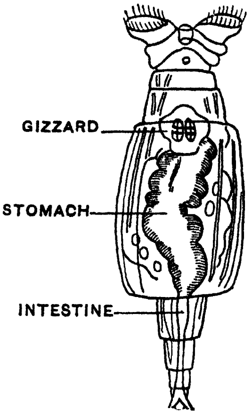
Rothamsted, an agricultural experimental station near Harpenden, Hertfordshire, founded by J. B. Lawes in 1843, with J. H. Gilbert as director. In 1889 Lawes created and endowed with £100,000 a Trust for the maintenance of the experiments. The station is administered by a committee of management, four of whom are nominated by the Royal Society, two by the Royal Agricultural Society, and one each by the Chemical and Linnean Societies and the owner of Rothamsted.—BIBLIOGRAPHY: *The Guide to the Experimental Plots* (an annual publication); A. D. Hall, *Book of the Rothamsted Experiments.*

Rothenburg-ob-der-Tauber (rō'ten-bṳr*h*; ‘ above the Tauber ’), a town of Bavaria, in Middle Franconia, on a height above the Tauber. The mediæval walls, towers of defence, and gateways are still complete. Pop. 9000.

Roth'erham, a county and municipal borough of England, in the West Riding of Yorkshire, on the Don; served by the North-Eastern, the Midland, and the Great Central railway systems. The fine Perpendicular church dates from the time of Edward IV; the grammar-school from 1483. The manufactures include iron, steel, and brass goods, railway wagons, glass, chemicals, and earthenware. Pop. (1921), 37,953.

Rothesay (roth'sā), a royal and municipal burgh, seaport, and favourite watering-place of Scotland, chief town of the county of Bute, is beautifully situated at the head of Rothesay Bay on the north-east of the Island of Bute; served by railway and other steamers. Its prosperity in great measure depends upon its popularity as a health-resort. Its climate is very mild in winter. The ruined castle, supposed to have been originally built in 1098 by Magnus Barefoot of Norway, was partially restored between 1871 and 1877. Rothesay gives the title of duke to the Prince of Wales. Pop. 15,218.

Rothschild (rŏt'shilt; in English generally pronounced roths'chīld or ros'chīld), the name of a family of Jewish bankers, distinguished for their wealth and influence. The founder of the banking-house was Meyer Anselm Bauer (1743–1812), a poor orphan, who established a business in Frankfurt, at the sign of the Red Scutcheon (Roth Schild). He gained the friendship of the Landgrave of Hesse, who appointed him his agent, and in 1802 he undertook his first Government loan, raising ten million thalers for Denmark. At his death in 1812 he left five sons, the eldest of whom, Anselm Meyer von Rothschild (1773–1855), became head of the firm in Frankfurt, while the others established branches at various foreign capitals: Solomon Meyer (1774–1826) at Vienna, Nathan Meyer (1777–1836) in London, Karl Meyer (1788–1855) at Naples, and Jacob (1792–1868) at Paris. The bold, yet skilful and cautious operations of the Rothschilds during the troubled political years after 1813 confirmed the fortunes of the firm. Nathan Meyer in particular distinguished himself by his energy and resource. By means of special couriers, carrier-pigeons, swift sailing-boats, &c., he was frequently in possession of valuable information (e.g. the result of the battle of Waterloo) even before the Government, and skilfully turned his advantage to account. The Rothschilds are chiefly famous for the enormous loans which they raise and manage for different European Governments. Lionel Nathan (1808–79) was the first Jew who sat in Parliament, and in 1885 Baron Nathan von Rothschild (born 1840, died 1915) was raised to the English peerage.—Cf. Ignatius Balla, *Romance of the Rothschilds.*



Rose-coloured Rotifer (*Philodina roseola*), greatly enlarged

Rotif'era, Rotatoria, or **Wheel Animalcules,** a phylum of microscopic animals, inhabiting both salt and fresh water, distinguished by the possession of an anterior disc-like structure (*trochal disc*), furnished with vibratile cilia or filaments and capable of being everted and inverted at will. The popular name of ‘ Wheel Animalcules ’ is derived from an apparent rotatory motion in the cilia which fringe the front disc. The body is usually elongated and generally covered with a chitinous skin. The head region is well marked. A highly specialized digestive system is usually developed, at least in the females. The nervous system is represented by a single ganglionic mass. The sexes are found in different individuals; but the males are smaller. Locomotion is carried on by means of the cilia of the trochal disc, which also serve to sweep particles of food towards the mouth.

Rotrou (ro-trö), Jean de, French dramatist, born 1609, died 1650. He was the author of thirty-five plays all deservedly popular, the best of which are *Le Véritable Saint Genest*, *Venceslas*, *Don Bertrand de Cabrère*, *Antigone*, *Hercule Mourant*, and *Cosroes*.

Rottenburg, a town of Württemberg, on the Neckar, in the centre of a hop-growing district. It has a Roman Catholic cathedral, and an old castle (1216) of the Counts of Hohenberg, now a prison. Pop. 9000.

Rotten-stone, a soft stone or mineral, called also *Tripoli* (q.v.). Most of the rotten-stone of commerce is derived, like that of Derbyshire, from the decomposition of siliceous limestones, fine quartz being left behind when the calcium carbonate goes into solution.

Rotterdam, the chief port and second city of the Netherlands, in the province of South Holland, on the Nieuwe Maas or Meuse, at its junction with the Rotte, about 14 miles from the North Sea, with which it is also directly connected via the Hook of Holland by a ship canal, the Nieuwe Waterweg[1] (built 1866–90), which admits the largest vessels. The town is intersected by numerous canals, many of which are lined with rows of trees. The principal church is the Groote Kerk, or church of St. Lawrence, consecrated in 1477 and later restored, with a conspicuous tower about 210 feet high. The Boymans Museum houses an important collection of paintings. The Groote Markt has a statue of Erasmus, who is Rotterdam's most illustrious son. Rotterdam contains shipbuilding-yards, sugar-refineries, distilleries, breweries, tobacco-factories, machine-works, and manufactories for chemicals, artificial manures, and margarine; but its mainstay is commerce. It not only carries on a very extensive and active trade with Great Britain, the Dutch East and West Indies, and other transoceanic countries, but, as the natural outlet for the entire basin of the Rhine and Maas, it has developed an important commerce with Germany, Switzerland, and Central Europe. Four or five large barges, each of 1000 to 2000 tons, are towed up the Rhine from Rotterdam to Mannheim by powerful steamers. The water area of the port is about 300 acres, and there are some 15 miles of quays. The chief imports are petroleum, coffee, grain, raw sugar, oils, tobacco, spices, drugs, fish, coal, and ores; and the principal commodities exported are coffee, cigars, sugar, spices, wine, beer, petroleum, chemicals, metals, machinery, cheese, fruit, and spirits. Rotterdam is a great port of departure for emigrants from the Continent.

As a port Rotterdam is surpassed only by Hamburg and Antwerp on the European continent. The adjacent town of Delfshaven was incorporated with it in 1886, and other places have been incorporated since. Pop. (1920), 510,538.

Rotti, or **Rottee**, one of the Lesser Sunda Islands, Dutch East Indies, separated from the south-west end of Timor by a strait 5 miles wide; area, 653 sq. miles; pop. about 70,000, ruled by native chiefs under the Dutch Resident of Timor. Sugar, cotton, tobacco, indigo, and rice are produced by the Malay inhabitants.

Rot′tlera, a genus of plants of the nat. ord. Euphorbiaceæ, comprising over eighty species, occurring chiefly in the Indo-Malayan region. The principal species is *Rottlera tinctoria* (*Mallotus philippinensis*), from which is obtained the dye and vermifuge *kamala*.

Rottweil (rot′vīl), an ancient town of Germany, in Württemberg, on the Neckar. The manufactures comprise explosives, textiles, machinery, and leather. Pop. 9000.

Rotu′mah, an island of the Pacific (12° 28′ S. lat., 177° 20′ E. long.), 4 to 5 miles wide and about 16 miles long; hilly, of volcanic origin, producing coco-nuts and copra. It was ceded to Britain by the native chiefs in 1881.

Roubaix (rö-bā), a great manufacturing town of France, in the department of Nord, near the Belgian frontier. It is a highly important seat of the French textile industry. Woollens, cottons, linen, and silk, or mixed stuffs, are chiefly made; there are numerous dye-works; and the industries embrace also india-rubber goods, soap, beet-sugar, and machinery. Pop. (1921), 113,265.

Roubillac (rö-bi-yák), or **Roubiliac**, Louis François, French sculptor, born at Lyons in 1695, died in London in 1762. He settled in England in the reign of George II. He executed a number of monuments in Westminster Abbey, produced statues of Handel, Shakespeare, Sir Isaac Newton, George II, and a large number of portrait busts.

Rouble, a silver coin, the standard of money in Russia before the Revolution of 1917; equal to about 2*s*. 1·6*d*. A rouble is divided into 100 kopecks.

Rouen (rŏ-ăṇ), the old capital of Normandy, France, now chief town of the department of Seine-Inférieure, on the Seine. It is the fourth port of France. Among the many examples of mediæval architecture are: the cathedral (thirteenth-century Gothic), the churches of St. Ouen and St. Maclou, the Palais de Justice, the Hôtel de Ville, the Hôtel de Bourgthéroulde, the archbishop's palace, and the distinctive Tour de la Grosse-Horloge (1889), restored in 1892. Rouen has important manufactures of *rouenneries* (a kind of coarse striped or checked fabric) and other cotton goods. It has also manufactures of chemicals, beetroot-sugar, earthenware, and confectionery; and bleachfields, dyeworks, and foundries. The port was greatly extended during the occupation of Rouen as a British headquarters in the European War. Rouen is the *Rotomagus* of Roman times. In the ninth century it became the capital of the Northmen or Normans; and after the Norman Conquest it remained in the possession of England till 1204. The English retook it in 1418, but finally lost it in 1449. In 1431 it was the scene of the trial and execution of Joan of Arc. Pop. (1921), 123,712.

---

[1] The Nieuwe Waterweg is actually a deepened and broadened, or canalized, arm of the Maas.

Rouen imports not only for local needs, but for Paris and a large section of Eastern France. Coal is imported mainly from the United Kingdom, but also by sea from Germany via Antwerp and Rotterdam. Petroleum is also received on a large scale. A most notable feature of the port has been its growth during the last twenty years, and the export and import tonnage is expected eventually to exceed that of Havre and Marseilles combined. The secret of this growth is to be found in the dredging and canalizing of the Seine, which have made the port accessible to large ocean-going steamers. Rouen has four railway stations, and is on the Western (Paris-Le Havre) and Northern (Rouen-Amiens) systems.

Rouge, a form of ferric oxide, (Fe_2O_3), obtained by heating ferric hydroxide or ferrous sulphate in air. It forms a fine red powder, and is used as a red pigment in paints, in the manufacture of flint-glass, and as a polishing powder under the name of jewellers' rouge. The name is also given to various coloured cosmetics.

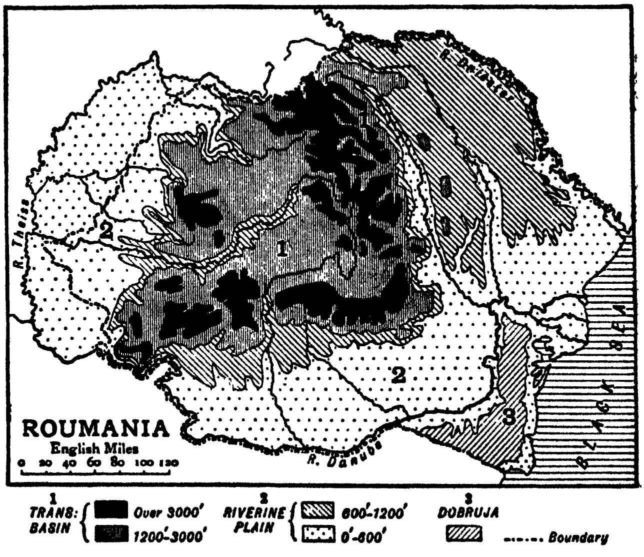
Roulers (rö-lär; Fl. *Rousseiaere*), a town of Belgium, in West Flanders, on the Mandel. The chief industrial establishments are cotton and woollen factories; and it has an important linen-market. Pop. 26,000.

Roulette (rö-let′); Fr. 'little wheel'), a game of chance, in which a small ivory ball is thrown off by a revolving disc into one of 37 or 38 compartments surrounding it, and numbered from 1 to 36, with one or two zeros. Players who have staked upon the number of the compartment into which the ball falls receive thirty-six times their stake; less if they have staked upon more than one number.

Rouma′nia (Roum. *România*), a kingdom of South-Eastern Europe, roughly circumscribed by the three great rivers Theiss, Danube, and Dniester, and having a coast-line on the Black Sea. It is composed as follows:

Territory.	Area, sq. Miles.	Population.
Old Roumania	53,489	7,900,000
Bessarabia	17,146	2,350,000
Bukowina	4,030	800,000
Transylvania	22,312	2,678,370
Crisana	8,038	1,316,900
Maramuresh	6,258	766,700
Banat..	11,009	1,582,140
Greater Roumania ..	122,282	17,394,110

Physiography.—New Roumania is roughly coextensive with the classical *Dacia*, and, except for the Dobruja, its whole area lies north of the Danube. It does not form a part of the Balkan Peninsula, although it is frequently alluded to as 'the largest of the Balkan states', and has more in common with the Carpathian Mountains on the one hand, and the South Russian steppes on the other, than with the Balkans. There are three distinct regions (see map): (1) the mountain-girt basin of Transylvania, which is encircled by (2) the riverine plains of the Danubian affluents, and across the Danube in the south-east, and (3) the plateau-steppe of the Dobruja.



The essential core of the area is the Transylvanian basin, which forms an elevated region surrounded by mountains of from 2000 to 8000 feet altitude. From the Pietros node (7560 feet altitude) in the north to the Upper Alt (Aluta) Valley in the south stretch the afforested Carpathians, flanked in the west by groups of volcanic origin, and continued in the south by the Transylvanian Alps, to the Iron Gates of the Danube. In the eastern and south-eastern ridges rise the Sereth, Ialomita, Argeş, Alt (Aluta), and Schyl, affluents of the Danube; on the west rise the Theiss and its tributaries the Szamos, Körös, Maros, and the Temes, an affluent of the Danube.

The Transylvanian Alps form part of a dissected plateau, and comprise a series of flat-topped ridges and uplands, used especially as pasture and grazing land. They rise to over 8000 feet altitude in the peak of Negoi, and fall in forested slopes to the basin in the north, and, more gradually, through foothills to the Wallachian plain in the south. In the west the Bíhar massif completes the natural ramparts of the basin, but the actual frontier of Roumania extends westward to embrace the rich agricultural lands of the Banat of Temesvár (Temişoara), &c. Though the mountains form the natural boundaries of the basin, they do not make the area in any way inaccessible. (Cf. *Communications.*) There are numerous passes, the most famous of which are the Red Tower Pass and the Predeal Pass, formed by the gorge of the Prahova and guarded by Braşov (Kronstadt).

The riverine lands east and south of the mountains form geographically a tongue of the great Russian plain. This plain consists politically of Wallachia, Moldavia, and Bessarabia, and is flanked on the north by the mountains and valuable pasturages, &c., and on the south by the Danube. The Pruth (q.v.) traverses this region. The Dobruja, lying between the Danube and the Black Sea, consists of (1) the delta of the Danube, (2) the wooded and hilly country of Babadag plateau, and (3) the southern steppe country. Roumania has access to the Black Sea through the Dobruja and Bessarabia. The Dobrujan coast-line is divided into three sections by Capes Kali Akra and Midia. From Ekrene north to Cape Kali Akra is Kavarna Bay, the only portion of the Old Roumanian seaboard affording safe anchorage for vessels of all sizes. Between Cape Kali Akra and Cape Midia, Mangalia and Constanţa are the only places suitable for shipping. The coast is very low and sandy from Cape Midia, with large salt lagoons stretching for miles inland. The Bessarabian seaboard extends northward from the Danube delta to the estuary of the Dniester, and is generally lagoon-fringed, low, and marshy. Climatically, Roumania is continental, with hot summers and cold winters. Autumn is the finest season. Sinaïa, in the Transylvanian Alps, is the favourite summer-resort of Bucharest society, and the mean temperatures there are about 16° F. in January and 71° F. in July and August, with a mean annual rainfall of 16 inches (410 millimetres). The corresponding figures for Bucharest are 17° F., 85° F., and 31 inches (810 millimetres) respectively.

Towns.[1]—The principal towns and approximate populations are as follows: Bucharest (capital, pop. 309,000), Constantsa or Constanţa (27,670), Chisinau (114,000), Czernowitz (87,200), Ismail (85,600), Jassy or Iaşi (76,200), Galatz (73,500), Temişoara (72,250), Brăila (65,900), Oradia Mare (64,170), Arad (63,166), Cluj (60,000), Ploëşti (57,400), Craiova (51,900).

Communications: Rivers.—The navigable rivers of Roumania are the Danube, Pruth, and Sereth (q.v.), but their utility as commercial water-ways is diminished by the large quantities of sand and mud washed down in spring, by the difficulties of locking occasioned by spring floods, and by the dryness of summer and autumn, when frequently the water-supply is insufficient to make barge navigation a possibility. Timber is rafted on the Bistriţa, a tributary of the Sereth. *Railways.*—There are about 7250 miles of railway, all under the general direction of the State.[2]

Production and Trade: Agriculture.—In order of importance, the chief corn crops are maize, wheat, barley, oats, and rye, which, together with colza, linseed, and rape, are cultivated throughout the country, except in the mountainous districts. The largest production comes from the valleys of the Pruth and Sereth in Moldavia, and the plains of the Danube in Wallachia. Sugar-beet and tobacco with some fruit (in the sub-montane regions of Transylvania) are produced; stock-raising is practised on the plains of the Lower Danube. Before the European War Roumania ranked fifth among the great wheat-exporting countries of the world, coming after Russia, Canada, Argentina, and the United

---

[1] The place-name spellings adopted here are, as far as possible, those favoured by the Permanent Committee on Geographical Names of the Royal Geographical Society (*First and Second General Lists of European Names*).

[2] The spoliation of Old Roumania during the European War left the railway system totally inadequate for the requirements of the Old Kingdom, and practically useless for the handling of the enormously increased traffic of Greater Roumania. Before the war Old Roumania possessed over 900 locomotives in actual service, and in 1919 there were not more than 400. About 1380 were in service during 1922, and another 3000 were held by the State Railroads. Of this 3000 more than half required actual rebuilding, and nearly all of the remainder were derelict. A great problem before the railroad engineers is that of linking up Transylvania with the railroad system of the Old Kingdom. When the Roumanian frontier was adjusted by the Treaties of Peace, the Transylvanian railroads were cut away completely from their previous base, and in order to focus them on to the railroads of Old Roumania and the Danube ports it will be necessary to build new lines between the large towns, as well as further routes between Bukowina and Transylvania, and Moldavia and Transylvania, so that the productive regions of the new territories may be connected with their natural trade outlets, the Danube ports. If railway routing should be deficient, Transylvania, which was formerly a part of the Kingdom of Hungary, will look to the railway system centring on Budapest, instead of to the Danube ports and to Bucharest, for supplies of manufactured goods.

States, but before India. *Forestry.*—About 18,500,000 acres are afforested, 6,820,000 acres being located in the Old Kingdom. Oak, beech, fir, elm, poplar, and alder are the chief trees. Willows, alders, and poplars thrive in the islands of the Danube, and indeed, in the Lower Danube region, every kind of product, animal or vegetable, is characterized by unequalled rapidity of growth. *Fisheries.*—Preserves are State-owned and confined to the large lakes and lagoons and the Lower Danube, and operated partly by the State and partly by lessees. Fish include the carp, sturgeon, mullet, sterlet, pike, perch, and tench, and the fisheries are richer than any elsewhere in Europe, except the Volga. Fish-markets are located at Galatz, Tulcea, Brăila, Bucharest, and Craiova. *Minerals.*—Lignite, anthracite, salt, amber, iron-manganese (ore containing 35 per cent of iron), copper ore, marble, and granite are worked.

Petroleum is the principal mineral, and wells are worked in the departments of Prahova, Dambovița, Bacău, and Buzău; but 90 per cent of the production comes from Prahova, where it is produced in sixteen different localities, including the Bustenari group—Moreni (which produces 50 per cent of the Roumanian total), Campina, Băicoin, Tintea, Bordeni, Runcu, and Gropi. Five localities in Dambovița and four in Bacău are also engaged. The approximate annual production (1912–21) was as follows:

Year.	Tons.	Year.	Tons.
1912	1,770,000	1917	517,000
1913	1,885,000	19 8	1,214,000
1914	1,784,000	19-9	920,000
1915	1,673,000	1920	1,034,000
1916	1,244,000	1921	1,164,000

About 75 per cent of the total production is accounted for by three large companies, viz. (1) the Astra-Romana, formerly a German concern—production, 322,000 tons; (2) the Steana Romana, in which the controlling interest was formerly held by the Deutsche Bank, but is now transferred to Roumanian-French - British ownership, British and French interests amounting to 51 per cent in a total capital of 300,000,000 lei—production, 230,000 tons; and (3) the Romano Americana, in which all the shares are held by the Standard Oil Company of America—production, 250,000 tons. These figures are approximate. Others are the Roumanian Consolidated Oil-Fields, Limited (British), the Orion (Dutch), and the Danube Oil Trading Company of Roumania, Limited (British), but there are a vast number of other companies and syndicates. About 70 per cent of the total production of petroleum in Roumania is taken up for internal consumption at very low rates, and this is naturally a handicap on development. For example, nearly all the Roumanian locomotives in use on the railways are adapted to use as fuel a mixture of petroleum and coal, coke, or wood, and most stations are fitted with storage-tanks. Oil-refining is carried on at the oil-fields, or at large distributing centres, e.g. Cernavoda, Ploësti, Galatz, Bucharest, Constantsa, and Băicoin. There is a State pipeline to Constantsa, the great oil-exporting port of Roumania, but it is 10 inches in diameter in some places, and only 5 inches in others, which restricts the quantity of oil that can be moved, and also causes endless trouble with pumping operations.

Social Conditions: The People.—The Roumanians are descendants of the Roman colonists introduced by Trajan (cf. *History*), and an earlier Dacian people. When the colony was abandoned by the Emperor Aurelian (A.D. 270), the ancestors of the modern Roumanians withdrew to the mountains, and did not return until the twelfth century. This commingling of Dacian and Roman formed a community which even now preserves, in language and in sympathy, and even in its name of Roumania, its connection with the Latin peoples of the west. New Roumania, considered ethnologically, forms quite a satisfactory unit, and although many foreign elements appear in the post-European War acquisitions, the Roumanian people still form the vast majority of the population, and none of the miscellaneous peoples when taken separately form one-tenth of the total. (Cf. *Language.*) *Religion.*—Rather more than half of the people belong to the Orthodox Church (9,700,000); 1,400,000 are Roman Catholic, 1,400,000 Greek Catholics, 1,300,000 Protestants, 800,000 Jews, and 44,000 Mahommedans. The clergy of the National Orthodox Church are paid by the State, but toleration and full liberty of all creeds are enforced by law. *Education.*—Where there are schools, education is free and compulsory; universities are located at Bucharest, Jassy, Cluj (Transylvania), and Cernauti or Czernowitz (Bukowina). *Health.*—Malaria is prevalent in the marshy riverine areas, and the region between Călăraşi and Galatz, on the Danube, is particularly unhealthy. Pellagra is common among the peasantry, but, unlike malaria, it does not affect strangers to the country, and is caused in some obscure manner by the conditions of life obtaining among the indigenous population. Epidemics of smallpox are frequent, and cholera and typhus are occasional visitants. *Money, &c.*—The monetary unit is the *lĕu* of 100 *bani*, which is equivalent to the franc.

Government.—Roumania is a constitutional monarchy hereditary in the Royal House of Hohenzollern - Sigmaringen, and possesses a bicameral legislature.

History.—The country that is now Roumania was anciently part of Dacia (q.v.), which was conquered by Trajan and made a Roman province in A.D. 106, a great many Roman colonists being then settled in it. In the third century it was overrun by the Goths, and subsequently by Huns, Bulgars, Avars, and Slavs, all of whom have left more or less distinct traces on the land and people. The nucleus of the modern kingdom is the pre-European War kingdom, consisting essentially of Wallachia and Moldavia. These principalities started as semi-agricultural, semi-pastoral communities, and developed independently. At the beginning of the ninth century Wallachia and Moldavia formed part of the great Bulgarian kingdom, after the fall of which (1019) it nominally belonged to the Byzantine Empire, but fell under Turkish domination (1456). In Wallachia the boyars or feudal nobility retained the nominal right of electing the Voivodes (princes) until 1726; but thenceforward the Sultan openly sold the office to the highest bidders, who, without security of tenure, mercilessly plundered the unfortunate province as long as their power lasted. In Moldavia, after the death of the Voivode Stephan the Great (1458–1504), the principality, which comprised also the Bukowina, fell under the overlordship of the Porte. The Turks subsequently introduced the same custom of farming out the Hospodarship or Voivodeship, the purchasers usually being rich Greeks of Constantinople. The anti-Greek attitude still common among Roumanians dates from this period. The successive wars between Russia and Turkey, the first of which began in 1768, were on the whole beneficial to Roumania, for the Russians gradually established a kind of protectorate over their fellow-Christians on the Danube. The Treaty of Paris in 1856, after the Crimean War, confirmed the suzerainty of the Porte, but preserved the rights and privileges of the Danubian principalities, and added to them part of Bessarabia. The two provinces were united in 1861, but the Hospodar Cuza was forced to abdicate in 1866, and Prince Carol of Hohenzollern-Sigmaringen was elected in his place. In the Russo-Turkish War of 1877–8 Roumania sided with Russia, and proclaimed its independence of Turkey. This claim was recognized by the Treaty of Berlin in 1878, but Roumania was compelled to retrocede to Russia the part of Bessarabia acquired in 1856, and to receive the Dobruja (peopled largely by Bulgarians) in exchange. In 1881 Parliament declared Roumania to be a kingdom, the prince assuming the title of Carol I. Roumania's problem now centred in Transylvania, where nearly 3 million Roumanians lay under the yoke of Hungary, and in Bessarabia, the seizure of which by Russia in 1878 deprived her of a million more. This Russian annexation threw Roumania into alliance with the Teutonic Powers, and King Carol was for many years a sleeping partner in the Triple Alliance. Still, the keynote of Roumania's policy right up to the European War must be sought in her desire to redeem her brethren from their bondage to Hungary. That consideration availed at length to bring Roumania to fight on the side of the Allies. Roumania's declaration of war arrived at Vienna on 28th Aug., 1916 (see *European War*).—BIBLIOGRAPHY: *Peace Handbook No. 23* (in vol. iv, part ii. *Balkan States*, H. M. Stationery Office); *Roumania* (*Admiralty Handbook*, compiled by Geographical Section, Naval Intelligence Division); Mrs. W. Gordon, *Roumania Yesterday and To-day*; W. Miller, *The Balkans* (Story of the Nations Series).

Language.—Roumanian (less correctly *Wallachian*, a purely relative title applied by the Germans in the sense of 'foreign', *Walh*) is the outcome of the popular Latin first carried into Dacia by the Roman legionaries. The history of the speakers of this *limba romanesca* has been entangled with that of the Teutons, Slavs, Greeks, and Bulgars in ways that have left obvious traces upon the language. In vocabulary it has been calculated that over 40 per cent of the words in literary use are Slavonic,[1] less than 35 per cent popular Latin, and the rest derived from Turkish, Greek, and other sources. Some words are probably Old Dacian. A peculiarity of the language, as compared with the other Romance tongues, is that the article is suffixed, as in Bulgarian. Thus *omul* (= Lat. *homo ille*), 'the man'; *ochiul* (= *oculus ille*), 'the eye'. Roumanian is spoken by about 10,000,000 persons, of whom 9,000,000 form the northern or *Daco-Roumanian* division, in Old Roumania (Wallachia and Moldavia), Bessarabia, Transylvania, Bukowina, Banat of Temesvár, &c. Within this area dialectical differences are of little account. A southern division, which possesses no literature, is formed by the *Macedo-Roumanian* (or *Vlach*) of parts of Roumelia, Macedonia, and Thessaly. This has been much influenced by Greek and Albanian.

Literature.—Roumanian literature falls into three periods. In the first, covered by the sixteenth and seventeenth centuries, Slavonic was the official language of both Court and Church. After the Reformation movement, the Roumanian language was gradually substituted for Slavonic. The literature began with translations of the Bible, the Gospels, the first books of the *Pentateuch*, and Homilies; then followed the whole of the New Testament, and a larger number of Homilies, with Codes of Law. Finally a translation of the whole Bible appeared in Bucharest in 1688, and a translation of the Gospels both in Greek and Roumanian in 1693. The latter became the authorized version, and was ordered to be read in the churches. Independent writings appeared in the shape of chronicles. The chief names of this period are: Coresi (1570), Evstratie (1632), Miron Costin (about 1670), Dosofteiu (1673), and Greceanu (1691). In the second period, from about 1710 to 1830, Greek influence was paramount. Many writings of the Church Fathers, and some old romances, were translated into Roumanian. By the end of the seventeenth century Slavonic had been entirely discarded, and the language as well as the literature had become rich and expressive. The principal writers of this period are: Prince Cantemir (1698),

---

[1] The traditional Roumanian law, as well as many customs and popular beliefs, are of Slav origin. There are also traces of Bulgarian, Greek, and Albanian fusion; but, nevertheless, the wonderful vitality of the Latin element has justified the Roumanians in adopting the tradition of their Latin origin.

Antim the Iberian (1703), Nicolæ Costin (1713), Neculce (1742), and Văcărescu (1796), with whom begins the writing of independent poetry. Some of these writers mark the transition from the second to the modern period, which began at the end of the eighteenth century with a successful movement for the substitution of the Latin alphabet for the old Slavonic, a change which brought Roumania into closer contact with the West. French influence thereafter dominated literary activity. Roumanian literature, however, is slowly attaining to independence even of this influence. The chief names to be mentioned are comparatively few: Beldiman (1821), Bolintineanu (1840), Balcescu (1850), Vasile Alexandri (1860), Eminescu (1880), and Carageali (1890) stand out prominently. Roumania possesses a very rich popular literature, which in the opinion of some surpasses that of any of the Western nations.—BIBLIOGRAPHY: M. Gaster, *Literatura Populară die Românǎ*; *Chrestomatie Roumaine* (2 vols.); *Geschichte der Rumänischen Litteratur* (in Gröber's *Grundriss der Romanischen Philologie*).

Round Table, The, a select fraternity of knights, said to have been established by Uther Pendragon, father of King Arthur, and when it was complete to have had 150 knights of approved valour and virtue. King Leodegraunce, who received the table from Uther Pendragon, was father of Guinevere, and assigned it as part of her dowry when she wedded Arthur. The fellowship of the Round Table met for the last time just before setting out on the quest for the Holy Grail. First mention of it is made in the *Brut* of Wace.—Cf. L. F. Mott, *The Round Table*.

Round Towers, a class of tall, narrow, circular towers, tapering somewhat from the base upwards, and generally with a conical top, from 60 to 130 feet in height, and from 20 to 30 feet in diameter. Some eighteen of them still exist in good condition, three in Scotland, one in the Isle of Man, and the rest in Ireland. The doors are from 6 to 20 feet from the ground, the windows small. The successive stories were reached, like the doors, by means of ladders. The towers date from the eighth or ninth to the thirteenth century. — Cf. Keane, *Towers and Temples of Ancient Ireland*.

Rousseau (rö-sō), **Jean Baptiste,** French poet, born at Paris in 1670, died in 1741. He was condemned to exile in 1712 for contumacy in refusing to appear before the law courts. He spent the remainder of his life chiefly in Vienna and the Netherlands. His works consist of sacred and secular odes, cantatas, epigrams, operas, comedies, and epistles.

Rousseau, Jean Jacques, French philosopher, was born at Geneva in 1712, died in 1778. For the first thirty-five years of his life the chief authority is his own painfully frank, but perhaps not absolutely accurate, *Confessions*, first published in 1782 and 1789. After a desultory education he was apprenticed in 1725 to an engraver, from whom he ran away in 1728. He then fell under the notice of Madame de Warens, a lady residing at Annecy, who sent him to a Roman Catholic institution at Turin, where he abjured Protestantism. He lived with Madame de Warens for nearly three years, but eventually lost her favour, and departed to become a tutor at Lyons. In 1741 he went to Paris, and in 1743 obtained the post of secretary to the French Ambassador at Venice. He returned to Paris in 1745, to lead a precarious life, copying music and studying science. About this time he became intimate with Diderot, Grimm, D'Holbach, and Mme D'Epinay, and contributed to the *Encyclopédie*; and from this period also dated his connection with Thérèse le Vasseur, with whom, five-and-twenty years later, he went through some form of marriage ceremony. In 1750 his essay, in which he adopted the negative side of the question whether civilization has contributed to purify manners, won a prize offered by the Academy of Dijon, and brought him for the first time into general notice. In 1752 he brought out a successful operetta (the music by himself), and soon after a celebrated *Letter on French Music*. In 1754 he revisited Geneva, where he was readmitted a free citizen on once more embracing Protestantism. Having returned to Paris, he wrote a sort of novel, *Julie, ou la nouvelle Héloïse*, which was published in 1760, being followed by *Le Contrat social*, a political work, and *Émile, ou de l'éducation*, another story, in 1762. The irreligious tone of these works roused public opinion against the author, and Rousseau fled to Neuchâtel, and finally to England, where he was welcomed by Hume, Boswell, and others in 1766. A malicious letter by Horace Walpole in 1767 caused him to return to France, where he lived in great poverty, supporting himself by copying music and publishing occasional works. In May, 1778, he retired to Ermenonville, near Paris, where he died in the following July. Rousseau united an enthusiastic passion for love and freedom with an inflexible obstinacy and a strange spirit of paradox. His life was clouded by a gloomy hypochondria, which often developed into suspicion of his truest friends. The chief importance of his works lies perhaps in the fact that they contain the germ of the doctrines which were carried out with such ruthless consistency in the French Revolution.—BIBLIOGRAPHY: Lord Morley, *Rousseau*; A. Chuquet, *Jean Jacques Rousseau*; H. Beaudoin, *La Vie et les œuvres de Jean Jacques Rousseau*; F. H. Gribble, *Rousseau and the Women he Loved*.

Rousseau, Pierre Étienne Théodore, French landscape-painter, born in 1812, died in 1867. Fontainebleau was the scene of many of his pictures, and here he settled, in the village of Barbizon, in 1848. From 1849 till his death he exhibited regularly at the Salon, gaining first-class medals in 1849 and 1855, and a medal of honour in 1867. Among his works are: *The Forest of Fontainebleau at Sunset*, *Landscape after Rain*, *Exit from the Forest of Fontainebleau*, *Stormy Morning during Harvest*, *Edge of the Woods near Barbizon*, *Storm Landscape*, *Farm in the Landes*, *Woods in Winter*, and *Autumn at St. Jean de Paris*.—Cf. J. W. Mollett, *The Painters of Barbizon*.

Roussillon (rö-sē-yōŋ), a pre-Revolutionary province of France, co-extensive mainly with the modern department of Pyrénées Orientales. The hereditary countship goes back to 893.

Rove-beetles, or **Cocktails**, the popular name of certain beetles. The common species is the *Ocypus olens*, the black cocktail, or 'devil's coach-horse'. These beetles are carrion-feeders.

Rovere'do, a town of Italy, in the Trentino, on the Leno, near its junction with the Adige. It is an important centre of the Tyrolese silk manufacture and silk trade. Pop. 16,000.

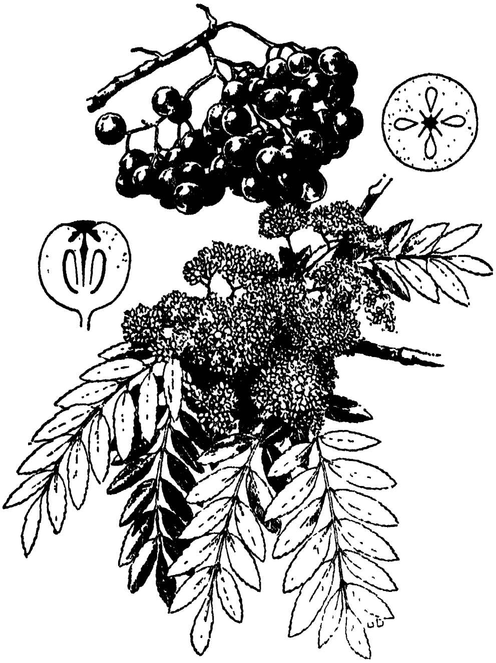
Rovigno (ro-vēn'yō), a seaport-town of Italy, formerly in Austria, on the Adriatic, 40 miles south of Trieste. It has a tunny and sardine fishery, marble-quarries, and manufactures of tobacco, cement, &c. Pop. 12,000.

Rovi'go, a maritime province of Venetia, North Italy, with a seaboard on the Adriatic. It is in the valley of the Po, which forms the southern boundary, and a flat, marshy area traversed by the Adige. Cereals, hemp, and cattle are produced; sericulture and viticulture are prominent industries. Area, 684 sq. miles; pop. 269,380.

Rovigo, a city of Venetia, North Italy, capital of the province of Rovigo, on the Adigetto, and a railway junction on the Padua line. Candles, silk, woollens, and leather are among the manufactures, and there are also brewing and dyeing industries. Pop. 13,000.

Rovu'ma, a river of East Africa, which rises on the east of Lake Nyasa, and flows nearly due east, with a course of about 500 miles, to the Indian Ocean. It marks the boundary between Tanganyika Territory and Portuguese East Africa.

Rowan Tree, or **Mountain-ash** (*Pyrus Aucuparia*), nat. ord. Rosaceæ, is a native of Europe and Siberia, common in Britain, particularly in the Highlands. Its leaves are pinnate, leaflets uniform, serrated, glabrous. It has numerous white flowers in corymbs. The fruit consists of clusters of small red berries, bitter to the taste. The tree attains a height of from 20 to 40 feet, and affords timber much used by toolmakers and others. The bark is used by tanners, and the berries yield a dye. The rowan tree was formerly regarded as an object of peculiar veneration, and a twig of it was supposed to be efficacious in warding off evil spirits. It is also called *quicken tree* and *quick-beam*.



Rowan Tree or Mountain-ash (*Pyrus Aucuparia*)

Rowe (rō), Nicholas, Poet Laureate and poetaster, born in 1674, and died in 1718. He was a king's scholar at Westminster under Dr. Busby, studied law at the Middle Temple, but on his father's death devoted himself to literature. In 1715 he was made Poet Laureate in succession to Nahum Tate. Rowe's tragedies are passionate and forcible in language, and his plots well conceived. His minor pieces are unimportant, but his translation of Lucan's *Pharsalia* has been deservedly praised. His best plays are *The Fair Penitent* (an adaptation of Massinger's *Fatal Dowry*) and *Jane Shore*; others are *The Ambitious Stepmother*, *Tamerlane*, *Ulysses*, *The Royal Convert*, and *Lady Jane Grey*. His comedy of *The Biter* was a failure. Rowe is not much remembered now as Poet Laureate or even as the author of the phrase 'gay Lothario'. His chief title to fame is that he was the earliest editor of Shakespeare, Hemings and Condell not deserving so lofty a title. His edition of Shakespeare appeared in 1709 in six volumes. His text is not authoritative, as he followed the Fourth Folio, but he collected a number of Shakespearean traditions, which he introduced into a memoir prefixed to the Works. This memoir is the sole authority for several important legends.

Rowing and Sculling. In rowing, three classes of boats are used, pairs, fours, and eights; probably the last-named are the most popular. Rowing, especially in an eight-oared boat, is an excellent form of physical drill. In the initial stages of training, the members of the crew are instructed individually, in a pair-oared boat. The rate of striking is at first slow, probably from 20 to 25 strokes per minute, in order that the necessary muscles may be gradually hardened. For a few weeks before racing all members of the crew are put into strict training, and the rowing is of shorter duration, but at higher pressure, the rate of striking being gradually increased till, at the finish, the crew can strike at the rate of 40 strokes to the minute. This rate of striking is for starting and spurting, the normal rate after the first two minutes being 35 or 36, with possibly an occasional spurt up to 40. The work for the last few days is usually of a lighter nature, such as two-minute sprints, starts of half a minute, and possibly a full course four or five days before the race. The success or failure of a crew will to a great extent depend on the *stroke* of the boat, who initiates the movements. His judgment should be of a high order, and he must keep a cool and clear head from start to finish of the race, and be prepared to take instant advantage of any mistake his opponents may make.

The ambition of all rowing men is to race at Henley, the classic regatta of the world, where any crew, home, colonial, or foreign, can compete, providing it holds the necessary amateur status. The distance is 1 mile 550 yards against the stream. The record time for an eight-oared race is six minutes fifty-one seconds, but although this record stands for the Henley course, it was beaten by the winners of the Olympic regatta in 1908, the Leander Club, probably the finest crew ever seen at Henley. They rowed the full course of 1½ miles in seven minutes fifty-two seconds, their time over the Henley course being six minutes forty-six seconds. Amongst other races of note was the Silver Goblets (pairs) in 1908, when two Thames Rowing Club pairs met and rowed a dead heat in eight minutes eight seconds, lowering all previous records by seven seconds, the one pair being veterans both over forty years old, and the other being between twenty-five and thirty. The crews tossed who should row in the final. The veterans won the toss, and the final the next day. In 1922 an American sculler named Hoover met J. Beresford, jun., the English amateur champion, in the final of the Diamond Sculls, and beat him by thirty seconds over the full course—one of the finest performances ever seen at Henley, J. Beresford, jun., being a very fine sculler, and winner of the English Amateur Championship in 1920, 1921, and again in 1922, beating all previous records by forty-two seconds. First and foremost, however, in the names of successful oarsmen at Henley comes that of Guy Nickalls, of the Oxford University Boat Club, who has won more medals, in all classes of racing, than any other competitor at this regatta.

Possibly the best-known and most popular race of the year is that between Oxford and Cambridge, from Putney to Mortlake, over the championship course, which is 4¼ miles in length. There have been seventy-four races in all, and only on one occasion, in 1877, was there a dead heat. It is also curious to note that only one man has stroked a winning university crew four years in succession. This fell to the lot of R. C. Bourne, of Oxford, who won in 1910, 1911, 1912, and 1913. On the last occasion both boats sank—Cambridge below Hammersmith Bridge, and Oxford half-way up Cheswick Eyot. The race was re-rowed on 1st April, and Oxford won. The record time for the course is eighteen minutes twenty-nine seconds, which was created by Bourne's crew in 1911.

Sculling demands more determination than rowing, and a far finer sense of balance, and a good oar may be a very indifferent sculler.—Bibliography: R. C. Lehmann, *Hints to Young Oarsmen*; Theodore Cook, *Rowing at Henley*; C. M. Pitman, *Boat Race 1829–1909*; H. T. Steward, *Records of Henley Royal Regatta*.

Rowland, Henry Augustus, American physicist, born 1848, died 1901. He graduated in 1870 at the Polytechnic Institute at Troy, New York. From 1876 he was professor of physics at the Johns Hopkins University, Baltimore. Some of his researches are historical, e.g. his proof that a charged body in motion produces a magnetic field similar to that of an electric current. His diffraction gratings made great advances possible in astronomical spectroscopy. By their aid he produced a standard map of the normal solar spectrum.

Rowlandson, Thomas, British caricaturist, born in London in 1756, died there in 1827. His caricatures are often coarse, but they are always full of humour, animation, and cleverness. Among his best-known works are: *Vauxhall Gardens*, *The Tours of Dr. Syntax*, *The Military and Naval Adventures of Johnny Newcome*, and his illustrations to various well-known books, such as Munchausen's *Travels* and Sterne's *Sentimental Journey*.

Rowley, William, English actor and dramatist, was born about 1585, and died about 1642. Prior to 1610 he acted in Queen Anne's company; in 1613 his company became known as the

Prince of Wales's. He joined the King's servants in 1623, and retired from the stage in 1627. He married in 1637, and is supposed to have died before the outbreak of the Civil War. Four extant plays are said to be entirely the work of Rowley, *A New Wonder, a Woman never vexed* (printed 1632); *All's Lost by Lust* (printed 1633); *A Match at Midnight* (1633); and *A Shoomaker a Gentleman* (1638). None of these plays are unqualified successes. Rowley owes his fame mainly to the fact that he collaborated with several men more gifted than himself. He collaborated with Wilkins and Day, with Heywood, Massinger, Dekker, Ford, and Webster, but especially with Middleton, with whom he wrote *The Changeling*, *The Spanish Gipsy*, the masque *The World Tost at Tennis*, and other excellent plays. Middleton and Rowley were ideal partners, and each had a good influence upon the work of the other. *The Birth of Merlin: or, the Childe hath found his father* was first published in 1662 by the bookseller Kirkman, who attributed it to Shakespeare and Rowley. It is certain, however, that Shakespeare had no hand in this play, and there is no reason to suppose that he and Rowley ever worked together. Rowley was so prolific a collaborator that at one time 'When in doubt, attribute to Rowley' was a canon of criticism among scholars who specialized in deciding the authorship of joint-stock plays. Rowley's one prose work, *A Search for Money* (1609), gives an amusing account, in the vein of Dekker, of contemporary London life.—BIBLIOGRAPHY: A. C. Swinburne, *The Age of Shakespeare*; P. G. Wiggin, *An Enquiry into the Authorship of the Middleton-Rowley Plays*; Sir A. W. Ward, *History of English Dramatic Literature*.

Rowley Regis, an urban district of Staffordshire, England, 5 miles from Birmingham. It is in a coal-mining area, and has potteries, ironworks, and foundries. Pop. (1921), 40,040.

Roxburghshire, an inland border county of Scotland, is bounded by Dumfries, Cumberland and Northumberland, Berwick, Midlothian and Selkirk. It is served mainly by the Waverley route of the North British Railway, with branches from St. Boswells to Roxburgh, Jedburgh, and Kelso. The Cheviot Hills stretch along the southern border. The county lies within the basin of the Tweed, and is traversed by the Teviot, one of its tributaries, which gives the county the alternative title of Teviotdale. The Tweed also flows through the north of the shire for some 26 miles; other streams are the Ale, Jed, Liddle, Borthwick, and Gala. Roxburghshire is chiefly occupied by valuable sheep-walks, but its arable farms are also among the best in Scotland. The important tweed and hosiery manufactures, of which Roxburghshire is the principal Scottish seat, are confined to the towns, of which the chief are Hawick (much the largest town), Jedburgh (the county town), Kelso, and Melrose. The rivers produce an abundance of fish, particularly salmon.—BIBLIOGRAPHY: Sir G. Douglas, *Roxburgh, Selkirk, and Peebles*; Sir Walter Scott, *Minstrelsy of the Scottish Border*.

Royal Academy of Music, an institution established in London, in 1823, to provide a first-class musical education in all branches of the art, especially to professional students. It was incorporated by royal charter in 1830. It receives a grant of £500 per annum from Government, but is mainly supported by fees. It confers the title of Licentiate, Associate, and Fellow; and conducts local and school examinations jointly with the Royal College of Music. Since 1911 the Academy has occupied new buildings at York Gate, Regent's Park.

Royal College of Science, an institution at South Kensington, London, which grew out of the Government School of Mines and Science, instituted in 1851, and with the Royal School of Mines and the City and Guilds College is now comprised in the Imperial College of Science and Technology, established in 1907. A number of exhibitions and free studentships are awarded by competition. Students may obtain the diploma either of Associate of the Royal College of Science (A.R.C.S.) or of the Royal School of Mines (A.R.S.M.), besides other diplomas.

Royal Institution of Great Britain, The, was founded by Count Rumford in 1799. Its objects are to promote research and the spread of scientific knowledge. It has a library of 60,000 volumes. The chemical and physical laboratories have been associated with the names of Young, Davy, Brande, Faraday, Tyndall, Frankland, Odling, J. H. Gladstone, Dewar, Rayleigh, and J. J. Thomson. There are three professorships, Natural Philosophy, Chemistry, and Physiology.

Royal Society (London), The, the oldest scientific society in Great Britain, and one of the oldest in Europe, organized in London for the study and promotion of natural science. It owes its origin to a club of learned men who were in the habit of holding weekly meetings in London as early as 1645, but the year 1660 is generally given as the year of its foundation. Charles II took much interest in the proceedings of the society, and in 1662 granted a charter to the "President, Council, and Fellows of the Royal Society of London for Improving Natural Knowledge". Lord Brouncker was first president of this incorporated Royal Society. Meetings are held weekly from November to June for the purpose of reading and discussing scientific papers; and the more important of these are published in the annual *Philosophical Trans-*

actions, first issued in 1665, and now forming a most valuable series. Accounts of the ordinary meetings, with abstracts of papers, &c., appear also in the periodical *Proceedings*, begun in 1800. Scientific research has at all times been both initiated and encouraged by the Royal Society, and many of the most important scientific achievements and discoveries have been due to its enlightened methods. It deservedly enjoys an influential and semi-official position as the scientific adviser of the British Government, and not only administers the £4000 annually voted by Parliament for scientific purposes, with an additional £1000 since 1896 in aid of publications, but has given suggestions and advice which have borne valuable fruit, from the voyage of Captain Cook in the *Endeavour* in 1768 down to the *Challenger* expedition, more than a century later. It awards the Copley, Davy, Hughes, and two royal medals annually, the Rumford and Darwin medals biennially, and other medals at longer intervals, for distinction in science, the first being the blue riband of scientific achievement. Among its presidents have been Samuel Pepys, Sir Isaac Newton, Sir J. Banks, Sir Hans Sloane, Sir Humphry Davy, Professor Huxley, Lord Kelvin, Lord Lister, and Lord Rayleigh. Candidates for admission to the fellowship must be recommended by six Fellows. From the names of those so recommended fifteen are selected by the council annually and submitted to the society for election by ballot. Eminent foreign scientists, not more than fifty in number, are also admitted as Fellows.—Bibliography: C. R. Weld, *History of the Royal Society*; H. B. Wheatley, *Early History of the Royal Society*; *Record of the Royal Society* (1901).

Royal Society (Edinburgh), a society founded and chartered in 1783 for the promotion of physical and literary research. Its activities are now confined to science. Its meetings are held twice a month from November to June, and the more important papers then read are published in the *Transactions*, and abstracts of them in the *Proceedings*. The library of over 50,000 volumes is the most complete scientific reference library in Scotland. The chief promoter of the society was Principal Robertson, the historian; among its early members were Hume, Reid, Edmund Burke, Hutton, Dugald Stewart, and James Watt; and among its presidents have been Sir Walter Scott, Sir David Brewster, the Duke of Argyll, Lord Moncrieff, and Lord Kelvin.

Royalty, originally a seigniorage due to the king from a manor of which he is lord, or a land-tax paid to a superior as representing the king. Hence the word came to be applied to a tax paid either to the Crown or to a land-owner on the produce of a mine. Besides this latter sense there is the sense of a tax paid to the holder of a patent for the use of the patent, generally at a certain rate for each article manufactured; or a percentage paid to the owner of an article for its use. Authors, dramatists, and musicians commonly receive royalties, whether on the number of copies sold or on the number of public performances of the work in question.

Royan (rwå-yäṇ), a seaport and bathing-resort of France, in the department of Charente-Inférieure, at the mouth of the Gironde. Pop. 9300.

Royat-les-Bains (rwå-yå-lā-baṇ), a popular watering-place of Central France, in the department of Puy-de-Dôme, 1880 feet above the sea. There are thermal springs impregnated with carbonic acid and sodium bicarbonate. Pop. 1700.

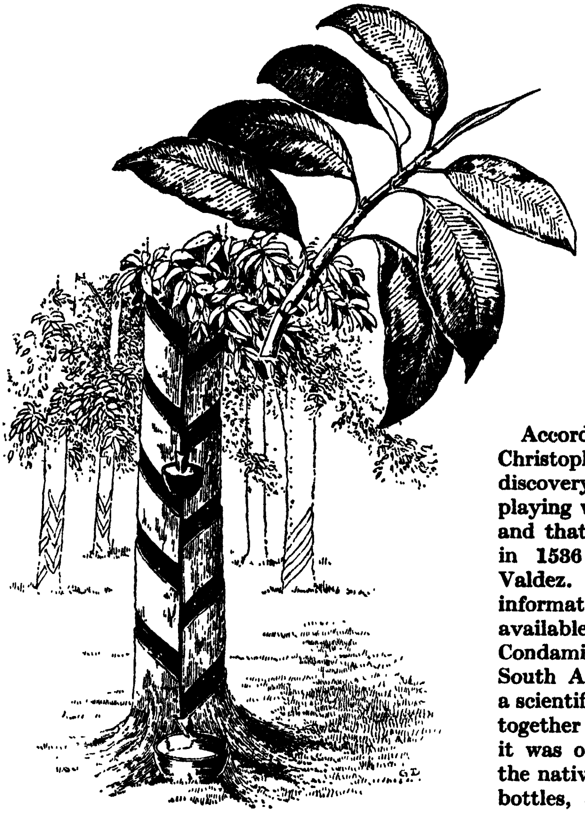
Royer-Collard (rwå-yā-kol-är), Pierre Paul, French philosopher, born in 1763, died in 1845. In 1810 he became professor of philosophy in the University of France. He was president of the Chamber of Deputies in 1828. Royer-Collard introduced the philosophy of the Scottish or 'common sense' school to France, and became the recognized head of the 'doctrinaire' school of which Jouffroy and to a certain extent Cousin were afterwards the chief representatives.—Cf. E. Spuller, *Royer-Collard.*

Royton, an urban district of Lancashire, England, near Oldham. Pop. (1921), 17,200.

Ruabon′, a town of North Wales, in Denbighshire, with collieries, ironworks, brickworks, and tileworks. Pop. 3400.

Ruanda and Urundi. See *Urundi and Ruanda.*

Rubber, or **India-rubber,** a soft, elastic substance obtained from the latex of a variety of tropical trees and shrubs, of which it forms the principal component (up to 50 per cent of the fresh milky juice). The two most important rubber-producing trees are natives of South America, and belong to the nat. ord. Euphorbiaceæ. *Hevea brasiliensis*, extremely abundant in the Amazonian forests, furnishes Para rubber, which ranks first in regard to quality. Ceara rubber is obtained from *Manihot Glaziovii*, a tree nearly related to the Cassava plant (*M. utilissima*), and less dependent than Hevea on constant humidity and heat. Another American rubber-producer of commercial importance is *Castilloa elastica*, the source of Ule or Castilloa rubber, a member of the Urticaceæ, to which family also belongs the Assam rubber tree, *Ficus elastica*, the only rubber-yielding plant indigenous to Asia; the familiar 'rubber plants' of our greenhouses are young specimens of *Ficus elastica*, but in its native haunts the tree grows to an enormous size. The most valuable rubber tree of Africa is *Funtumia* (*Kickxia*) *elastica*, the product of which is known as Lagos rubber, although the bulk of the rubber exported from that continent is derived from climbing species of Landolphia belonging to the same family (Apocynaceæ). Many other rubber-yielding plants are known, mostly members of the three natural orders above mentioned, but all are of minor importance.



A Method of removing the Bark from a Rubber-producing Tree to promote the defensive flow of the Latex. Above, a Sprig of *Ficus elastica.*

More than nine-tenths of the world's supply of rubber is procured from the *Hevea brasiliensis* tree, either in its wild form as it occurs in the great forests on the banks of the River Amazon, or in its cultivated form as grown in plantations in the surrounding mainlands and the larger islands of the Indian Archipelago. The coagulation of Amazon Hard Fine Para—the highest grade of wild *Hevea brasiliensis* rubber—is effected by allowing the latex to flow gently on to a wooden former or paddle placed in position on a crude trestle. The fluid adheres to the paddle, which is kept rotating in the smoke arising from a closed-in fire made from palm nuts and resinous wood. The effect of this operation is to evaporate the watery portion of the latex and leave on the paddle a thin film of smoked rubber that will retain its strength and elastic properties for many years. This process of drying a film of latex is repeated until a large ball or biscuit is built up. The rubber is then detached from the paddle and is ready for transportation and use in manufacture. The coagulation of Plantation Para rubber, on the other hand, is accomplished almost exclusively by chemical means. After straining the latex to remove particles of dirt, bark, leaves, and other foreign matter, a small quantity of diluted organic acid (generally acetic acid) is mixed with the latex, and the rubber particles floating in the latex are massed together to form a creamy curd or jelly-like substance firm enough to be handled. This coagulated product—to produce the simplest type of Plantation rubber—is then flattened into sheets between steel rollers, and after drying these sheets are practically pure rubber, and ready for the market.

According to the historian Antonio de Herrera, Christopher Columbus on his second voyage of discovery (1493–6) saw the inhabitants of Haiti playing with balls made from the gum of a tree; and that rubber was so used was also recorded in 1536 by Gonzalo Fernandez d'Oviedo y Valdez. But it was only in 1735 that accurate information as to the exact origin of rubber was available in Europe. In that year M. de la Condamine, who had been deputed to go to South America by the French Government on a scientific mission, sent home samples of rubber together with a description of the tree from which it was obtained, and the methods followed by the natives in making waterproof articles, shoes, bottles, &c. Later, in 1751, another French explorer, Fresneau, supplemented the data furnished by de la Condamine; but these reports, valuable as they were, led to no practical outcome, and for several decades the substance remained more or less a curiosity known to only a restricted circle. The first mention of rubber being put to practical use in Europe was made by the British scientist Dr. Priestley, who in the introduction to his treatise on the *Theory of Perspective* (1770) referred incidentally to *caoutchouc* (as rubber was then called; native name *cahuchu*) as a substance eminently suitable as an eraser from paper of the marks of lead pencils, an attribute which apparently appealed to the popular imagination, for thenceforward the substance became known in the English language as ' rubber '. In course of time articles of native manufacture began to percolate through from Brazil to the United States and Europe. Though of very primitive make, these articles attracted the attention of industrialists, and as a consequence early in the nineteenth century a number of factories were started in England, France, and America for the manufacture of rubber goods; and waterproof materials, garments, and elastic fabrics were produced. In use, however, these original goods had objectionable qualities. In extreme cold they became hard and dry, and under the influence of considerable heat they turned soft and sticky. Eventually, with one or two notable exceptions, particularly British firms, which are still in existence, the concerns engaged in the manufacture succumbed to financial difficulties.

Vulcanization.—At length (1839) the problems incidental to the manufacture of rubber into really serviceable goods were solved by the discovery of *vulcanization* by Charles Goodyear, an American. This discovery, which rested on the principle that rubber mixed with sulphur and subjected to a temperature above the melting-point of the latter undergoes an entire transformation in its physical and chemical properties, gave the manufactured product qualities unobtainable from the raw rubber alone. The somewhat unstable and plastic tacky material was made firm and inadhesive, tough, elastic, and durable, highly resistant to acids as well as to electricity, and to all intents and purposes unaffected by any normal range of heat or cold, or by any of the solvents that dissolve it in the unvulcanized state. In point of fact, an entirely different substance was evolved, and a new era opened up for rubber manufacture. Vulcanization, or ‘ curing ’, as it is also designated, is, practically speaking, the last process in the manufacture of rubber. The rubber is cleaned by being mechanically torn into small pieces, and is thereafter washed by means of rollers revolving in a continuous flow of water. The effect of the washing operation is to turn out the rubber in sheets having the appearance of a *crêpe* cloth, an appearance due to the action of the corrugated steel rolls running at unequal speeds. After the completion of the washing process, the sheets are dried either in warm air or *in vacuo.* At this stage the rubber is in condition for *mixing* or, as it is also sometimes called, *compounding*. It is here that the sulphur which will assure vulcanization is added, and at the same time many other chemicals necessary to give finish, colour, weight, hardness, durability, resistance to oil, steam, or acids. In this process the rubber sheet is reduced to a plastic state by being worked repeatedly between hot steel rollers, the sulphur and other chemicals in powdered form being incorporated intimately by sprinkling or scooping them on to the rubber as it winds round the rolls. When the mixing has been completed, the soft mass obtained can readily be rolled out into sheets, placed in a mould, shaped in the die of a forcing machine, or laid or *spread* on textile fabrics by means of suitable machines. But in whatever way a particular article may be turned out or built up from the prepared mixed rubber, it is still in a raw or unfinished state until it has been subjected to the master process of vulcanization, carried out to-day so far as heavy goods are concerned by steam heat in a vulcanizing stove or chamber, or in the case of the lighter goods by subjecting them to the vapours of sulphur chloride, or in a recently discovered method considered to have wide possibilities, by allowing sulphur dioxide and sulphuretted hydrogen to react in contact with the rubber. Whichever of these processes may be employed, however, it constitutes a reaction between rubber and sulphur, and, once this has been effected, the chemical change is permanent.

Plantations.—Over £100,000,000 of British capital are invested in rubber plantations, £87,500,000 being in Malaya. About 57 per cent of the world's rubber is produced in Malaya; the United States consumes 80 per cent of it. In 1918 upwards of 1,100,000 acres of plantations existed in British Malaya alone; and of a total world output (1919) of 343,000 tons, 300,000 tons represents plantation, and the rest wild rubber. Until 1910 Brazil dominated the rubber markets, but in that year Britain assumed a control which has since been maintained. Between 1908 and 1920 plantation rubber became an exceptionally remunerative investment. Production, however, began to exceed demand, prices fell rapidly, and a crisis was reached in 1920, when cost of production (viz. 40 cents, or 11*d.* per pound) was far in excess of market price (viz. between 6*d.* and 7*d.* per pound). In a country like British Malaya, whose finance is dependent on rubber and tin, this was serious, and a Government Committee (Sir James Stevenson's) recommended (1) restriction of output, (2) expansion of demand, and (3) Anglo-Dutch co-operation. During the slump, European planters endeavoured to reduce production, but this was rendered futile by Chinese planters, who automatically increased output to meet the falling prices. In Jan., 1923, however, prices of certain classes of rubber had risen to 1*s.* 3*d.* per pound.

Rubefa′cients are drugs which, when applied locally to the skin, cause it to become red because of the vascular dilatation induced. The most commonly used are ammonia, silver nitrate, mustard, camphor, oil of turpentine, cantharides, and capsicum.

Ru'bellite, a rose-red variety of tourmaline (q.v.).

Ru'bens, Peter Paul, Flemish painter, was born in 1577 at Siegen, in Westphalia, died at Antwerp in 1640. His father, a lawyer of Antwerp, had fled to Germany owing to his Calvinist faith; and Rubens's childhood was spent chiefly at Cologne. After the death of his father in 1587 Rubens's mother returned with him to Antwerp, where a brief education laid the foundation for his later reputation as one of the most learned and accomplished men of his time. At the age of thirteen he entered the studio of the landscape-painter Verhaegt, then spent four years with Adam Van Noort, and finally studied under Otto Van Veen. In 1598 he was admitted as a master of the guild of painters in Antwerp, and in 1600 went to Italy, where he remained till 1608, chiefly at the court of the Duke of Mantua, whence he visited Rome and Spain, at the former coming under the influence of Caravaggio. He returned to the Netherlands in 1608 with an established reputation, and the Archduke Albert attached him to his court, with a salary of 500 livres. Rubens married his first wife, Isabella Brant, in 1609, and settled down in Antwerp to a successful and brilliant career. His studio was crowded with pupils and assistants, among them Teniers the younger, Van Dyck, Jordaens, and Frans Snyders; and their help made possible his enormous output. A masterpiece of this period is the famous *Descent from the Cross*, in Antwerp Cathedral. In 1622 he was commissioned by Marie de' Medici to design for the gallery of the Luxembourg the well-known series of magnificent allegorical pictures, illustrating the life of that princess, which are now in the Louvre. After the death of his wife in 1626 he was employed in diplomatic negotiations by the Archduchess Isabella, who had succeeded her husband as Governor of the Netherlands, and in 1628 he was sent to Madrid in connection with the important private negotiations for a peace between Spain and England. Here he came into touch with Velasquez, copied Titian, and painted some original work. In 1629 he was sent, in continuance of his mission, to London, where he painted for Charles I the ceiling of the banqueting hall in the palace at Whitehall, now the United Services Institution. In 1630 he married Helene Fourment, who appears in many of his later works, notably the *Helena Fourment and Children* (Louvre) and *Helena Fourment in a Fur Cloak* (Vienna), and settled once more in Antwerp. In 1635 he retired to the Château de Steen, which appears in an important group of landscapes, and there painted unceasingly till his death. To this later period belong such masterpieces as *The Battle of the Amazons* (Munich) and *The Kermesse* (Louvre). Rubens is unrivalled in facility and mastery of execution, and, even allowing for the help of pupils and assistants, in the amount of work produced. Working for preference on a large scale, he unites with a Flemish realism and sense of colour, a feeling for design based on study of the Italians, to produce an art unrivalled in vitality and the expression of dynamic energy. His range is immense, and his influence on every type of painting has been widespread, especially during the eighteenth century. He is adequately represented in the National Gallery, but his finest and most characteristic works are on the Continent.—BIBLIOGRAPHY: Max Rooses, *Rubens: sa vie et ses œuvres* (English translation, 1904); Hope Rea, *Peter Paul Rubens* (Great Masters in Painting and Sculpture); E. Dillon, *Rubens*; E. Michel, *Peter Paul Rubens: his Life, his Work, and his Time.*

Ru'bia, a genus of plants, type of the order Rubiaceæ, inhabiting Europe and Asia. Several species are employed in medicine and the arts. *R. tinctorum* is the madder plant, *R. cordifolia* is munjeet.

Rubia'ceæ, a large natural order of gamopetalous dicotyledons, including all gamopetalous plants with opposite leaves, interpetiolar stipules, stamens inserted in the tube of the corolla and alternating with its lobes, and an inferior compound ovary.

Ru'bicon, a river of ancient Italy (now the Fiumicino), famous in Roman history, Cæsar having by crossing this stream (49 B.C.), at that time regarded as the northern boundary of Italy, finally committed himself to the civil war. Hence the phrase ' to pass the Rubicon ' is to take the decisive step by which one commits one's self to a hazardous enterprise.

Rubid'ium, symbol, Rb; atomic weight, 85·45, one of the rarer alkali metals; was discovered by Bunsen and Kirchhoff in 1860, by the aid of the spectroscope, in Dürkheim waters. It occurs in lepidolite, petalite, and other minerals, is a silver-white, soft metal, has a bright metallic lustre, and rapidly tarnishes and oxidizes. See *Cæsium.*

Ru'binstein, Anton Gregor, great Russian pianist, was born at Volhynia in 1829, died in 1894. His first public appearance was made in Moscow at the age of nine. In the following year he set out on his first concert tour, in the course of which he visited Paris, meeting there his only possible rival, Franz Liszt. After some years spent in study he appeared as a fully matured artist and entered on a triumphant career, winning fame all over Europe and America. In 1885 he began a series of farewell appearances throughout Europe, visiting London in May and June, 1887, where he gave a set of seven historical recitals. At the close of this final tour he again assumed the direction of the St. Petersburg Conservatorium, which he had founded in 1862. Rubinstein was a prolific composer, but is only remembered now for the extraordinary power and beauty of his playing.

Rubric, in the canon law, signifies a title or article in certain ancient law books, thus called because written in red letters (Lat. *ruber*, red). In modern use rubrics denote the rules and directions given at the beginning and in the course of the liturgy for the order and manner in which the several parts of the office are to be performed. Where red ink is not employed now the rubrics are printed in italics, or in some other distinctive character.

Rubruquis (rö′brụ-kwis), a distinguished traveller of the Middle Ages, otherwise *Willem van Rubruk*, born about 1215, died about 1270. He became a Franciscan missionary to the Holy Land, and in 1253 was dispatched by Louis IX of France on a semi-political, semi-proselytizing mission which took him into the heart of Asia, to the Great Khan of Tartary, then residing in the Gobi Desert. He brought back a mass of details, still valuable, about the countries he visited.—Cf. C. R. Beazley, *Dawn of Modern Geography*.

Rubus (rö′bus), a genus of plants, nat. ord. Rosaceæ. There are about a hundred species, among which are the British *R. Idæus*, or raspberry; *R. fruticōsus*, or common bramble; and *R. Chamæmōrus*, mountain-bramble or cloudberry.

Ruby, a precious stone of a pink-red colour, of which there are two varieties—the Oriental and the spinel. The Oriental ruby or true ruby is a transparent red corundum (q.v.) consisting of alumina, and is the most valuable of all precious stones. A ruby of five carats, if perfect in colour, is said to be worth ten times as much as a diamond of the same weight. Oriental rubies are found chiefly in Burmah and Siam; inferior specimens have also occurred in North America and Australia. Spinel rubies consist of an aluminate of magnesium, and are much inferior to the true rubies in hardness and value. They are found in Burmah, Ceylon, and Australia. Excellent rubies have been produced artificially by the fusion of alumina in an electric arc.

Ruby-tail, or **Ruby-wasp** (*Chrysis ignita*), a brilliantly coloured small insect, common in Great Britain, of the order Hymenoptera. They are called ‘cuckoo-flies’ from their habit of depositing their eggs in the nests of solitary wasps, on the larvæ of which they prey.

Ruby-throat (*Trochilus colubris*), a species of humming-bird, so named from the colour of its chin and throat. In summer it is found in America, from Guatemala to 57° N. lat.

Rückert (rük′ėrt), Friedrich, German poet and Orientalist, born in 1788, died in 1866. He was professor of Oriental languages at Erlangen, and afterwards at Berlin. His poems are very numerous, and he claims a place among the best lyrists of Germany. *Die Weisheit des Brahmanen* (6 vols., 1836–9) is among his most important Eastern works.

Rudd (*Leuciscus erythrophthalmus*), a fish of the carp family. The back is olive; the sides and belly yellow, marked with red; the ventral and anal fins and tail of a deep-red colour. It is common in Britain and throughout Europe (except Spain and Portugal), also in some parts of Asia. Its average length is from 9 to 15 inches. Called also *Red-eye*.

Rudder-fish, or **Pilot-fish** (*Naucrates ductor*), a fish allied to the horse-mackerels, common in the Atlantic and Pacific, so named from its habit of swimming around the sterns of ships. The term ‘pilot-fish’ has reference to the legend that it guides the ships and sharks it undoubtedly accompanies.

Ruddiman, Thomas, a celebrated Scottish scholar, born in 1674, died in 1757. He graduated at Aberdeen University, and became schoolmaster at Laurencekirk. From 1728 he was printer to the university; from 1729 he was proprietor of *The Caledonian Mercury*; and from 1730 till 1752 he was keeper of the Advocates' Library. His best-known work is his famous *Rudiments of the Latin Tongue* (1714), a book which immediately superseded all previous treatises of a similar kind, and long remained in use in the schools of Scotland.

Rudolf I, German Emperor, founder of the Imperial House of Austria, was born 1218, the eldest son of Albert IV, Count of Habsburg and Landgrave of Alsace, and died in 1291. In 1273 he was elected emperor, and was crowned at Aix-la-Chapelle. Ottocar, King of Bohemia, and of Austria, Styria, Carinthia, and Carniola, refused his homage, and the subsequent war and triumph of Rudolf laid a solid foundation for the future greatness of the Habsburgs. Rudolf employed himself in restoring order and peace within the empire, and suppressed all private fortresses. Few princes have surpassed him in energy of character and in civil and military talents.

Rudolf II, Emperor of Germany, son of Maximilian II, was born at Vienna 1552, elected emperor 1576, when already King of Hungary and Bohemia, and died in 1612. He was a weak ruler, neglected State affairs, and, being a rigid Roman Catholic, adopted severe measures against his Protestant subjects. War with the Turks broke out, and discontent everywhere prevailed. In 1607 his brother Mathias was elected King of Hungary, and in 1611 Rudolf was compelled to cede the crown of Bohemia also to his brother.

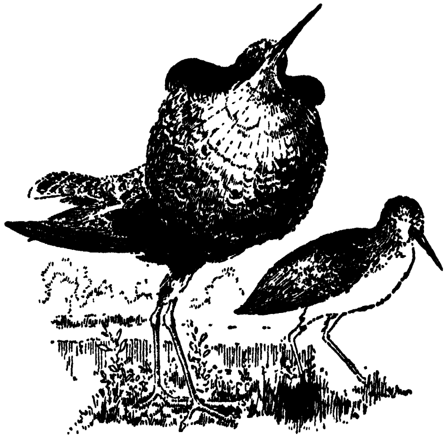
Rudolph, a province of North-Eastern Uganda. It is infested with gun-runners between Abyssinia and the Belgian Congo, and by Sudanese ivory poachers. There are great herds of camels, cattle, sheep, and goats, belonging to the Turkana tribe, and the Somaliland ass is found. Pop. 8,000,000.

Rudolph, Lake, a salt lake of East-Central Africa, in the Eastern Rift Valley, forming the converging point of the four frontier lines of Uganda Protectorate, Kenya Colony, Abyssinia, and the Anglo-Egyptian Sudan. It has an area of 3970 sq. miles, being 185 miles in length, and 37 miles broad at its widest point, and stands at 1250 feet altitude above sea-level. There is no outlet.

Ru′dolstadt, a town of Germany, capital of Schwarzburg-Rudolstadt, in the Republic of Thuringia, on the Saale. It manufactures pianos, cloth, porcelain, and chemicals. Pop. 13,000.

Rue, a strong-scented herbaceous plant of the genus Ruta, nat. ord. Rutaceæ, a native of Southern Europe, but also cultivated in gardens in Great Britain, &c. The root is perennial, woody; the stems about 2 feet high; the leaves alternate, petiolate, and divided; and the flowers yellow. It has useful medicinal properties. This plant is an ancient emblem of remembrance. The old name ‘ herb-grace ’ refers to this fact, or perhaps to its common use in sprinkling with holy water. Oil of rue is obtained by distilling garden rue (*Ruta graveŏlens*) with water, has a strong odour and bitter taste, and is used as an ingredient in aromatic vinegar.

Ruff (*Machētes pugnax*), a bird belonging to the plover family; length, 10½ to 12½ inches; plumage, variable, but usually brown on back and wings, white on belly. In the breeding season the male has its neck surrounded by long plumes, which when raised form a kind of tippet or ruff. The females are called *reeves*. The ruffs breed in the northern part of the Old World, and migrate to South Africa, India, and Japan.


Ruff and Reeve (*Machētes pugnax*)

Ruffe, or Pope (*Acerīna cernua*), a fresh-water fish of the perch family, native to northerly parts of Europe and Asia. It is 6 or 7 inches long, and is good eating.

Ruffed Grouse (*Bonăsa umbellus*), a North American species of grouse of the same genus as the hazel-grouse of Europe. It frequents forests and thickets.

Rufi′ji, a river of Tanganyika Territory, East Africa, rising north-east of Lake Nyasa, and entering the Indian Ocean opposite the Island of Mafia. On 11th July, 1915, the *Königsberg*, a German protected cruiser, was chased into the Rufiji River and destroyed by British warships.

Rugby, an urban district and market town of Warwickshire, England, on the Avon; an important railway junction. It is the seat of a famous boys' school. There are electrical engineering and cement works. Pop. (1921), 25,100.

Rugby School was founded (1567) by terms of the will of Laurence Sheriff, a grocer. The appointment (1828) of Dr. Arnold (q.v.) to the headmastership had an immediate and lasting effect on its standing, and it has since ranked as one of the first English public schools. Arnold was succeeded (1842) by Tait, the future Archbishop. Rugby's roll of distinguished pupils includes: Walter Savage Landor and Matthew Arnold; Judge Hughes, who immortalized both Dr. Arnold and the school in *Tom Brown's Schooldays*; with Lords Derby and Cross, Deans Stanley and Vaughan, and Mr. Goschen.—BIBLIOGRAPHY: W. H. D. Rouse, *History of Rugby School*; H. C. Bradby, *Rugby*.

Rugeley (röj′li), an urban district and market town of Staffordshire, England, on the Trent; served by the London & North-Western Railway. Near by are Cannock Chase collieries; there are also iron-foundries and tanneries. Pop. (1921), 4607.

Rügen (rü′gen), an island in the Baltic belonging to Prussia, near the coast of Pomerania; area, 377 sq. miles. The surface is fertile, undulating, and in many places covered with beautiful beech forests. The capital is Bergen. Many of the coast villages are popular sea-bathing resorts. From 1648 till 1815 Rügen belonged to Sweden. Pop. 49,000.

Ruhnken (rön′ken), David, German classical scholar, born 1723, died 1798. He was professor of history and rhetoric at Leyden University. Ruhnken published valuable and erudite editions of Timæus's *Lexicon Vocum Platonicarum* (1754), Velleius Paterculus (1779), and other works.

Ruhr (rör), a river of Germany, joins the Rhine at Ruhrort, about 19 miles north of Düsseldorf. It rises in Westphalia, and has a tortuous course of about 150 miles, flowing through the busy and prosperous Ruhr coalfield. During the European War the Ruhr district became an important German munition as well as industrial region. On the declaration of German voluntary default by the Reparations Commission, France, acting upon Part 8, Annex. 2, Paras. 17 and 18 of the Treaty of Versailles, decided to send into the Ruhr a Mission of Control. Italian Engineers and the Belgians co-operated, and on 11th Jan., 1923, the Franco-Belgian troops entered Essen. By 16th Jan., the French were in occupation of over 1200 kilometres of German territory.

Ruhrort (rör′ort), a town of Prussia, in the Rhineland, at the confluence of the Ruhr with the Rhine. It has a large harbour, and is one of the chief centres for the coal and other trade of the important industrial part of Westphalia. It was one of the towns occupied by the Allies in March, 1921, after Germany's refusal to pay the reparations due. Pop. 37,000.

Rule, Britannia, a British national song, of which the words, almost certainly by James Thomson, form part of the masque of *Alfred*, by Thomson and David Mallet, which was first performed in 1740. The music was written by Dr. Arne.

Rum, a hilly island of the Inner Hebrides, in Inverness-shire, Scotland, south of Skye, about 20 miles in circumference. The greatest elevation is 2667 feet. Area, 42 sq. miles; pop. 90.

Rume′lia, East, a district of South Bulgaria, comprising the provinces of Burgas, Philippopolis, and Stara Zagora. Agriculturally it is the richest and most productive portion of Bulgaria. Area, 15,190 sq. miles; pop. 1,250,000.

Rumex, a genus of plants belonging to the nat. ord. Polygonaceæ, occurring chiefly in the temperate zones of both hemispheres, the species of which are known by the name of *docks* and *sorrels*. Many are troublesome weeds.

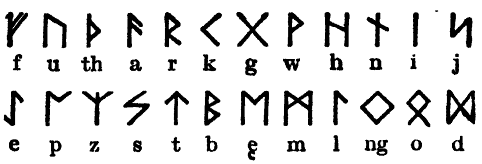
Rumford, Benjamin Thomson, Count, American physicist, born in 1753, died in 1814. He took the British side in the American War, and on going to England in 1776 received a Government post. In 1784 he entered the service of the Elector of Bavaria as Minister of War and Police. Rumford distinguished himself by his researches and discoveries as to the nature and application of heat. His Royal Society memoir of 1798, in which he combated the view that heat is a material substance, supporting his arguments by the results of experiments he had made on the heat developed during the boring of cannon, is important in the history of thermodynamics.

Ruminants, or **Ruminantia,** a group of herbivorous mammals, belonging to the order Ungulata or Hoofed Mammals, included in the Artiodactyle or 'even-toed' section of these, and comprising the five families Camelidæ (camel and llama), Tragulidæ (chevrotains), Cervidæ (true deer), Camelopardalidæ (giraffe and okapi), and Bovidæ or Cavicornia (ox, sheep, goat, antelope). The faculty of rumination ('chewing the cud') gives name to this group. Ruminants are distinguished from other orders by certain peculiarities of dentition. The most typical of the group, the ox, sheep, antelope, &c., have no incisor or canine teeth in the upper jaw, but have instead a hardened or callous pad against which the six lower incisors and the lower canines bite. The latter resemble incisors, and the Camelidæ and Tragulidæ possess also upper canines, while the former also have a pair of upper incisors. In both jaws are three premolars and three molars on either side, separated by an interval from the front teeth. The feet of ruminants are cloven. Horns, developed in pairs, are present in the majority of the species; either solid and bony, and shed annually, as in the antlers of the true deer; or persistent, consisting of a hollow horny sheath supported by a bony core, as in the ox, &c. The alimentary canal is very long. The stomach is divided into four compartments, frequently spoken of as four stomachs. The first and largest (*rumen* or *paunch*) receives the food roughly bruised by the first mastication, and transmits it to the second (*reticulum* or *honeycomb*), whence it is sent back in boluses to the mouth to be rechewed. This second mastication is called 'rumination' or 'chewing the cud'. The food is then reswallowed into the third stomach (*psalterium*, *omasum*, or *manyplies*), and passes finally into the true digestive cavity (*rennet stomach*, *reed*, or *abomasum*). Fluids may pass directly into any part of the stomach. In young ruminants, which feed upon milk, the first three 'stomachs' remain undeveloped until the animal begins to take vegetable food. Most of the ruminants are suitable for human food. They are generally gregarious, and are represented by indigenous species in all parts of the world except the Australian region.

Run′corn, an urban district, town, and riverport of Cheshire, England, on the Mersey and Manchester Ship Canal. It is connected with Widnes by a 'transporter' bridge and a railway bridge. There are extensive docks, chemical-, soap-, and rope-works, with some tanning and shipbuilding. Pop. (1921), 28,900.

Ru′neberg, Johan Ludwig, Swedish poet, born 1804, died 1877. His whole life was spent in Finland. From 1837 he was professor of Latin at Borgå College. His works, which hold a high rank in the literature of Sweden, include: *The Grave in Perrho*, a poetic romance; *The Elk Hunters*, an epic; *Hanna*, an idyllic poem; *Nadeshda*, a Russian romance; *King Fjalar*, a series of romances; *Ensign Stål's Stories*; and several volumes of lyrics, comedies, and prose essays.

Runes (Old Norse *rún*, secret, mystery, hidden lore), the letters of the alphabets peculiar to the ancient Teutonic peoples of North-Western Europe, found inscribed on monuments, tombstones, clog-calendars, bracteates, rings, weapons, &c., and only rarely and at a late period in manuscripts. They are formed almost invariably of straight lines, either single or in combination. Three runic alphabets (or 'futharks', as they are sometimes called from the first six letters) have hitherto been usually recognized: the Norse, with sixteen characters; the Anglo-Saxon, with forty; and the German; but modern researches have traced the common origin of these to an older primary Germanic or Teutonic futhark with twenty-four characters. Scandinavian and Anglo-Saxon tradition ascribes their invention to Odin. Runic inscriptions abound in Scandinavia, Denmark, Iceland, and the parts of England once known as Northumbria, Mercia, and East Anglia, but they are also found beyond these limits. The most noteworthy British runes are in Bewcastle, in Cumberland, on a cross in Ruthwell, in Dumfriesshire, on a casket in the British Museum, and on the Collingham stone in Yorkshire. Weapons and instruments, inscribed with runes, and dating from A.D. 300 to 400, have been dug up in Norway. The use of runes gradually disappeared under the influence of the early Christian missionaries. The latest runic inscriptions in Sweden date about 1450.—Bibliography: G. Stephens, *The Old Northern Runic Monuments of Scandinavia and England*; H. Hermannsson, *Catalogue of Runic Literature*.



Runic Alphabet

Rupert of Bavaria, Prince, cavalry leader in the English Civil War, the third son of Frederick V, Elector Palatine and King of Bohemia, by Elizabeth, daughter of James I of England, was born in 1619 at Prague, died in London in 1682. He came to England to assist his uncle, Charles I, and in 1642 was made General of the Horse. He distinguished himself at Edgehill and Chalgrove, captured Birmingham and Lichfield in 1642, and Bristol in 1643, and displayed his courage at Marston Moor and Naseby in 1645. His feeble defence of Bristol against Fairfax involved him in temporary disgrace with Charles; but in 1648 he was made admiral of the English Royalist fleet. He carried on a predatory naval war against the Parliament in European waters, until Blake forced him to escape to the West Indies. In 1653 he joined Charles II at Versailles. After the Restoration he was appointed Lord High Admiral, served with Monk against the Dutch, and became governor of Windsor Castle. His later years were devoted to scientific study, and he is credited with the invention of mezzotint engraving. He was one of the founders and the first governor of the Hudson Bay Company.

Rural Deans, officials in the English Church, dating from before the Reformation, were parish priests entrusted by the bishops with the duty of inspecting and reporting upon the conduct of clergy and people in groups of parishes. This office was revived during the nineteenth century from almost complete desuetude.

Rush, the common term for some of the different species of Juncus, nat. ord. Juncaceæ. The rushes have a glumaceous perianth of six sepals, glabrous filaments, three stigmas, and a three-celled many-seeded capsule. The leaves are rigid, mostly roundish, and smooth. Rushes are found chiefly in moist boggy situations in the colder climates; about twenty species are noted in the British flora. The name is also given to other genera besides Juncus.

Rushden, an urban district of Northamptonshire, England, near Wellingborough; served by the Midland Railway. Boots and shoes are the chief manufactures. Pop. (1921), 13,500.

Ruskin, John, British art critic and political economist, was born at London 8th Feb., 1819, died 20th Jan., 1900. He studied at Christ Church, Oxford; gained the Newdigate prize for his poem *Salsette and Elephanta* in 1839, and graduated in 1842. In 1867 he was Rede lecturer at Cambridge; from 1870 to 1879, and again from 1883 to 1884, he was Slade professor of fine art at Oxford, where in 1871 he gave £5000 for the endowment of a university teacher of drawing. From 1885 till his death he lived in seclusion at Brantwood, on Coniston Lake. In 1843 appeared the first volume of *Modern Painters, by a Graduate of Oxford*, in which Ruskin maintained the superiority of modern landscape-painters, especially Turner, to the older masters. The subsequent volumes expanded the subject into a comprehensive treatise on the principles which should underlie art, while similar considerations were applied to another domain of art in his *Seven Lamps of Architecture* (1849) and his *Stones of Venice* (1851–3). In 1851 Ruskin appeared as a defender of Pre-Raphaelitism, which had found inspiration in his works. As a political economist and social reformer he was an outspoken and uncompromising foe of what he considered the selfish and deadening doctrines of the so-called Manchester school, his chief works in this sphere being *Unto this Last* (1862), *Munera Pulveris* (1872), and *Fors Clavigera* (1871–84), a periodical series of letters to the working-men and labourers of Great Britain. Ruskin's literary output was very great. Many of his books were illustrated by drawings of his own. Among his works on economical, social, and ethical subjects may be mentioned: *Sesame and Lilies* (1865); *Ethics of the Dust* (1866); and *Crown of Wild Olive* (1866). Eloquence, force, and subtle analysis are the prevailing characteristics of Ruskin's literary style, while his works are at the same time permeated with a lofty enthusiasm for truth and beauty, and with a generous sympathy for the poor and the weak. Sometimes, however, he is betrayed into exaggeration, and not infrequently his propositions are needlessly violent and paradoxical, occasionally even contradictory. Met at the outset with keen and even bitter criticism, he has nevertheless given the impulse to a not unimportant renaissance in British art, though the new birth is, in many respects, very different from the ideal he held up. Scarcely less may be said of his work in political and social economy. —BIBLIOGRAPHY: Sir E. T. Cook, *Life of John Ruskin*; J. A. Hobson, *John Ruskin, Social Reformer*; A. C. Benson, *Ruskin: a Study in Personality*.

Russell, John, Earl Russell, English Liberal statesman, the third son of the sixth Duke of Bedford, was born in 1792, and died in 1878. Educated at a private school and at Edinburgh University, he entered Parliament in 1813. In 1831 he was Paymaster-General in Lord Grey's administration, and, though not in the Cabinet, introduced the first Reform Bill to the House of Commons. In the exciting struggle that followed Lord John Russell was popularly accepted as the great champion of reform. In Lord Melbourne's second Cabinet (1835–41) Russell was Home Secretary, and in 1839 he became Colonial Secretary. From 1841 till 1845 he led the opposition against Peel, with whom, however, he was in sympathy on the Corn Law question; and when Peel resigned in 1846 Russell formed a ministry and retained power until Feb., 1852. He re-entered office in Dec., 1852, as Foreign Secretary under Lord Aberdeen, and in 1855 became Colonial Secretary in Lord Palmerston's Cabinet, but resigned office in July of the same year. A period of rivalry between Lord John Russell and Palmerston now ensued, which, however, ended in 1859, when the former became Foreign Secretary under his old chief, by whom he was raised to the peerage in 1861. In 1865 Earl Russell succeeded Lord Palmerston in the leadership of the Liberal party, but when his new Reform Bill was rejected in 1866 the Liberals resigned. Thenceforward Earl Russell held no further office.

Russell, William, Lord, English statesman and political martyr, the third son of the fifth Earl of Bedford, born in 1639, died in 1683. He entered Parliament immediately after the Restoration, and took a prominent part in politics as a leader of the Whigs, animated by a bitter distrust of the Roman Catholics and a strong love of political liberty. He took a conspicuous part in the efforts to exclude the king's brother, the Roman Catholic Duke of York, from the succession to the throne, but retired from public life when the Exclusion Bill was rejected. When the Ryehouse Plot was discovered in 1683, Russell was arrested on a charge of high treason, and sentenced to death.

Russell, William Clark, British novelist, born at New York 1844, and died in 1911. He went to sea at an early age, but abandoned his nautical career in 1865 and took to literature. Among his most popular books are: *John Holdsworth, Chief Mate*; *Wreck of the Grosvenor*; *An Ocean Freelance*; *A Sea Queen*; *An Ocean Tragedy*; *List, ye Landsmen!*; and *The Romance of a Midshipman*.

✓**Russia**, prior to 1917, a great empire consisting of European Russia, Siberia, and the Caucasus region; total area, 8,417,814 sq. miles; pop. (1914), 171,059,000. Since the 1917 revolution (see below) it has lost Finland, Estonia, Lithuania, and Latvia, which are now independent states, Bessarabia, which has gone to Romania, and Russian Poland. Russia, however, still claims Bessarabia. The remainder has become the Union of Soviet Socialist Republics, with an area of 7,895,260 sq. miles, and a pop. of (1924) 132,009,098. (For constituent states, &c., see table.) *European Russia* is bounded by the Ural Mountains, the Ural River, the Caspian Sea, the Caucasus, the Black Sea, Romania, Poland, the Baltic States, the Gulf of Finland, Finland, and the Arctic Ocean. The surface is a vast undulating plain, the greatest height of which is 1110 feet in the Valdai Hills, where the most important rivers rise. In the surrounding ranges (Urals, Caucasus, and Carpathians) there are, of course, greater heights. The chief rivers are the Volga and the Ural flowing to the Caspian, the Kuban and Dnieper flowing to the Black Sea, the Don and the Donets flowing to the Sea of Azov, the Dvina flowing through Latvia to the Baltic, the Neva between Lake Ladoga and the Gulf of Finland, and the Onega, Northern Dvina, Mezen, and Pechora flowing to the Arctic Ocean. These rivers and their tributaries are all of immense importance for transport purposes, though they are all frozen in winter. The chief lakes are Ladoga and Onega in the north-west. North of the Arctic Circle lies the *Tundra*, frozen in winter, and covered with mosses for a few weeks in summer. South of this to a line through

THE UNION OF SOCIALIST SOVIET REPUBLICS (U.S.S.R.)

Republics in the U.S.S.R.		Constituent Republics, &c.	Capitals.	Area in Square Miles.	Population.	Notes regarding Situation, Minor Constituent Areas, &c.
The Russian Socialist Federal Soviet Republic.		European Russia.	Moscow, capital of the U.S.S.R. and the R.S.F.S.R.	1,122,990	60,163,900	Except the various autonomous portions, &c.
		North Caucasian Area (including Donets).		97,350	6,042,366	Except the Mountain Republic.
		[1] Siberia.		3,357,450	10,768,550	Except the various autonomous portions, but including the autonomous regions of Buryat-Mongol (1922, republic 1923) and Oiratsk (1922).
	Autonomous Republics.	Bashkir (1919).	Ufa.	40,020	1,268,132	East Central Russia.
		Tatar (1920).	Kazan.	25,700	2,852,135	
		Kirghiz (1920).	Orenburg.	835,210	5,058,553	Running from North Caspian into Asia.
		Gorski or Mountain (1921).	Vladikavkaz.	17,240	808,480	Including the autonomous regions of Kabarda (1921), Karachaevo-Cherkess (1922), Adigeevsko-Cherkess (1922), Chechensk (1922).
		Daghestan (1921).	Buinaksk.	13,600	798,181	West shore of Caspian.
		Crimea (1921).	Simferopol.	14,910	761,600	
		Yakutsk (1922).	Yakutsk.	1,457,070	301,000	North-eastern Siberia.
		Karelia (1923).	Petrodzavodsk.	28,600	144,392	Extreme north-west of European Russia.
		Chuvash (1925).	Cheboksari.	66,480	758,161	Centre—west of Tatar; auton. region since 1920.
	Autonomous Regions.	German Republic of the Volga (1918).	Marxstadt.	7,600	454,368	On southern Volga
		Kalmuck (1920).	Ellista.	38,260	126,256	North-west shore of Caspian.
		Marisk (1920).	Krasnokokshaisk.	59,760	300,069	Immediately north of Chuvash.
		Votyak (1920).	Izhevsk.	11,190	685,049	East of Marisk.
		Ziryansk or Komi (1921).	Ust-Seisolk	106,000	186,878	Running south from the Kara Sea (Arctic).
		Totals of R.S.F.S.R.		7,299,430	91,478,070	
Ukrainian S.S.R. ..		Ukraine (1920).	Kharkov.	172,760	26,001,802	Including the Moldavian S.S.R. (1924).
White Russian S.S.R. ..		White Russia (1919).	Minsk.	43,060	1,634,223	North of the Ukraine.
Transcaucasian Socialist Federal Soviet Republic		Azerbaijan (1918).	Baku.	33,640	3,600,000	
		Armenia (1918).	Erivan.	15,090	1,204,391	
		Georgia (1918).	Tiflis.	25,510	2,372,403	Including Abkhazia and Ardsharsk Republics and the autonomous region of Yugo-Osetie.
		Totals of T.S.F.S.R.		74,240	7,176,794	
Uzbek S.S.R		Uzbek (1924).	Bukhara.	124,292	4,803,600	These two republics were formed from Bukhara, Khorezm (Khiva), and the Turkistan Republic.
Turcoman S.S.R. ..		Turcoman (1924).	Poltorarsk.	181,478	914,600	
		Totals of the U.S.S.R.		**7,895,260**	**132,009,089**	

Dates of foundation are given in brackets.

Owing to the difficulty of obtaining reliable information many figures are approximations, but none are mere conjectures.

[1] Siberia is not a political division, but is used here for convenience.

Kazan and Leningrad is a region of great forests, and between a line drawn through Kazan and Kiev to the western boundary and the Black Sea is the black soil and *steppe* (grassy plain) region. Between these two lines, which meet at Kazan, and the western frontier is wooded grassland. For physical features of the rest of the Soviet Union see *Caucasus*, *Siberia*, *Transcaucasia*, &c.

Production, *Industry*, *&c.*, *of the Soviet Union.*—Russia is mainly agricultural, and the total area sown in 1924 was 205,000,000 acres, the chief crops being rye (*c.* 70,000,000 acres), wheat, oats, barley, millet, potatoes, sugar-beet, oil-seeds, cotton, flax, and tobacco. The area under timber in 1923 was 1,703,946,408 acres, of which 398,024,585 acres were in Europe. The total annual production of timber is *c.* 255,130,000 board feet. The mineral wealth is very great, especially in the Urals and the Caucasus, and comprises iron ore, copper, manganese, zinc, lead, and asbestos (from the Urals). Gold is found in Siberia. There are several coal-fields, the largest being in the Donets region, in the Urals, and around Moscow. Petroleum is found at Baku and around Grozni in Chechensk. The organization of industry is based on State ownership and control, and out of 4215 enterprises employing 1,171,831 workers in 1924 only 41 employing 17,837 workers were privately owned. The value of exports in 1923 was 210,600,000 roubles (133,200,000 at 1913 prices), and of imports 187,400,000 roubles (147,900,000 at 1913 prices). Exports to and imports from Britain in 1924 were valued at £19,774,000 and £3,860,000 respectively. The legal currency unit is the gold *rouble* of 100 *kopecks*, with a normal value of 2*s.* 1·6*d.* (or 9·46 roubles to the £ sterling). 10 gold roubles = 1 *chervonetz.* There are in the Union 45,044 miles of railway track, and the mercantile marine in 1924 had a tonnage of 421,130 tons. Of the 153,782 miles of rivers, canals, and lakes in European Russia, 20,670 are navigable for steamers, 7482 for small sailing vessels, and 88,739 for rafts. Under the Soviet régime the Græco-Russian (Orthodox) Church has been disestablished, though most of the people belong to it. It is governed by the Holy Synod. All religions may be freely professed, and there are many Mahommedans, Roman Catholics, Lutherans, and Jews (in the west and south-west provinces). Education of all kinds (including the theatre) is entrusted to the Commissariat of Education. Education is compulsory, and no private schools are permitted. All schools belong to the *Unified Labour* type, and are of two classes, for children aged 8–11 and for those aged 12–17. In grade I the children make the school self-supporting, and in grade II they work as members of the industrial life of the country. There are 23 universities, as well as innumerable institutes and faculties for medicine, economics, art, archæology, workers' education, &c. The *Workers' and Peasants' Red Army of Volunteers* is now fairly well disciplined, and is supplemented by a militia which is conscripted. The navy is of small value. In the Baltic are two dreadnoughts (1911), three cruisers (two old), some 15 destroyers, 8 submarines, and a few auxiliaries. In the Black Sea are a light cruiser (1918) and a few destroyers, and there are also one or more small ships in the Caspian, in the White Sea, on the Dnieper, and at Vladivostok. The flying service has from 50–60 aeroplanes. The total man power of the army, navy, and air force is believed to be 562,967 all ranks. The principal towns in the Union are Moscow (the capital), Leningrad, Kiev, Odessa, Kharkov, and Kazan. Trade with Russia by way of the Baltic passes through Latvia (port of Revel), the railway system of which connects with that of Russia.

Constitution, *&c.* — The Russia over which Lenin held sway in 1917 was nominally the whole of the former Empire except Finland, Estonia, Latvia, Lithuania, Poland, and the Ukraine. In reality Bolshevik government was only secure in the northern part of European Russia (i.e. in Muscovy). The success of the Bolsheviks in Siberia, Crimea, White Russia, &c., was by no means assured (see section on *History*), though opposition was gradually overcome. In any case, Russia was declared to be the Russian Socialist Federal Soviet Republic, the Constitution of which was drawn up in 1918. This Constitution has been the model for all subsequent Soviet Constitutions and for the Constitution of the Soviet Union (see below). It declares Russia to be a Republic of Soviets (i.e. councils) of Workers', Soldiers', and Peasants' Deputies, and all central and local authority is vested in these Soviets. Private property was abolished, all land being held by the people in common, and everything of national importance, all produce, live-stock, forests, buildings, means of transport, &c., are the property of the State. (These have been considerably modified, as shown in the section on *History*, for they proved uneconomic—in fact Bolshevism (q.v.) in its entirety is unworkable, and capitalism, private trading, &c., cannot be done without.) Only labourers may bear arms to defend the republic, and political rights are granted to all (no matter of what nationality) who reside in Russia for purposes of labour. All who employ others for profit are deprived of the franchise. Every town or village has its *Soviet*, which sends representatives to the district or provincial *Congress.* These Congresses meet annually, and elect Executive Committees to look after the districts for the ensuing year. The highest authority in the state is the *All-Russian Congress of Soviets,* which consists of delegates from all Town Soviets and Provincial Congresses of Soviets. This All-Russian Congress elects an *All-Russian Central Executive Committee* (386 members), the supreme legislative, administrative, and controlling body in the state. Current affairs are entrusted by the Executive to a Standing Committee (*Presidium*). The Central Executive also elects a *Council of People's Commissaries*, which is a Cabinet of 12 members. Each Commissary has under him a council. In time various autonomous Soviet Republics arose within Russia, some of them independent and some (together with the autonomous regions) federated to the R.S.F.S.R. The independent republics, all of which had Constitutions similar to that of the R.S.F.S.R. (indeed all autonomous republics and regions have) were Ukraine, White Russia, and the Transcaucasian Federation (Armenia, Azerbaijan, Georgia). In Dec., 1922, these three Soviet Republics and the R.S.F.S.R. formed the Union of Socialist Soviet Republics (U.S.S.R.). This was joined in 1924 by the Uzbek S.S.R. and by the Turcoman S.S.R. (See *Turkistan Republic* and consult table on p. 32). All the constituent states retain their own Soviet Constitutions and Governments, but some commissaries (e.g. *War* and *Foreign Trade*) only exist in the Union Government, others (e.g. *Education*) only exist in the Government of the republic, while some are common to both types. By the Union Constitution the Government consists of a *Union Central Executive Committee* and a *Union Council of People's Commissaries.* The former is elected annually by the *Union Congress of Soviets*, the supreme authority in the Union, and between congresses is the sovereign legislative, administrative, and judicial authority. It consists of two chambers, the *Union Council* (elected on the principle of proportional representation by the six constituent republics) and the *Council of Nationalities*, composed of 5 members from every autonomous republic and 1 member from every autonomous region. The *Presidium* (standing committee) transacts current business. The *Union Council of People's Commissaries* (Cabinet) is answerable to the Presidium, which alone makes war, ratifies treaties, receives the credentials of foreign diplomats, &c. Each commissary is head of a *collegium* (board) responsible for the work of its department. The population in Russia is very mixed, but the greater part of the people are Slavs, the main divisions being Great Russians (centre and north), Little Russians (Ukraine), and White Russians (White Russia). The Cossacks and the Ruthenians are Little Russians. Other races or elements are Lapps, Samoyeds, Circassians, Georgians, Tatars, Turcomans, Kirghiz, Kalmucks, Mongols, &c.

Language.—The Russian language is the most important of the Slavonic group of languages, and is spoken by about 120,000,000 people, both in Russia and in Galicia and Bukowina. It is one of the Slavonic family of the Aryan or Indo-European languages, and as such is a sister of Greek, Latin, Sanskrit, German, English, &c. There are three distinct dialects of the Russian language: (1) Great Russian, the basis of literary Russian, spoken in its purest form round Moscow; (2) Little Russian, or Ukrainian, spoken in the south and south-west of the country, and by the Ruthenians (it possesses a literature of its own); (3) White Russian, spoken in Lithuania and the western part of Russia, and showing a transition to Polish. Modern Russian has been much modified by the introduction of Greek, Tatar, and Mongolian terms. It has an alphabet of thirty-six letters, a written and printed character of a peculiar form, and a pronunciation which to the foreigner at first appears rather difficult. It has seven cases; three genders in nouns, adjectives, and past tenses of verbs; two varieties of participles; only three tenses; and a variety of augmentatives and diminutives. The absence of the article increases the force of the language, which is soft, sonorous, remarkable for its copiousness, and affords unbounded facility for rhyme.—BIBLIOGRAPHY: V. Dahl, *Explanatory Dictionary of the Living Great Russian Language*; A. Alexandroff, *Complete Russian-English and English-Russian Dictionary*; Bondar, *Simplified Russian Method*; Y. K. Grot, *Philological Investigations*; S. K. Bulich, *History of Russian Philology.*

Literature.—The introduction of Christianity in 988 created some taste for letters among the ancient Slavonians, but the chief remains of the early literature are fragments of traditionary tales in rhythmic verse, which have a certain similarity to the English, Spanish, and Scandinavian ballads. Among the earliest works reduced to writing is a book of the Gospels dating from 1056 or 1057. Early Russian literature is connected with Kiev, the mother of Russian cities, and the memory of its glory, as well as that of the Republic of Novgorod, is described in the epic songs or *bylini* (q.v.). *The Chronicle of Kiev*, or *The Chronicle of Nestor*, was written about the end of the eleventh century. The Tatar invasion arrested the progress of literature, and Russia fell back into barbarism, whence she only emerged again after the accession of the House of Romanov. The first Russian press was set up at Moscow in 1554. The revival of literature was at first confined to some crude and feeble dramatic performances, and, towards the close of the seventeenth and the beginning of the eighteenth centuries, to poor imitations of French, German, and other foreign works.

Michael Lomonosov (1712–65) wrote both in prose and verse, and did much to originate a national literature and to fix the grammar of the language. Gabriel Derzhawin (1743–1816) distinguished himself highly in lyrical and other poetry; and since then many writers have distinguished themselves in all departments. It is, however, principally to Nicholas Karamsin (1765–1826) that Russia owes the more general spread of literary taste. The foundation of the Russian Academy in 1783, and the issue of its great dictionary, also contributed towards it. The same perfection which Karamsin gave to prose, Ivan Dimitriev (1760–1837) gave to poetry. The modern period of Russian literature begins with the nineteenth century. Zhukovsky (1783–1852) developed Russian verse to its highest perfection, introduced romanticism, and delivered it from the overwhelming French influence by making literary Russia acquainted with English and German poetry. Among poets are: Pushkin (1799–1837), the father of modern Russian literature; Lermontov (1814–41), whose novel *A Hero of Our Time* is a masterpiece; Koltsov (1809–42); Nekrasov (1821–78); Nadson (1862–87); and Krylov (1768–1847). Among novelists of the nineteenth century are: Gogol (1809–52), who was the first to make Russian literature famous; Turgeniev (1818–83); Dostoievsky (1821–81), the great psychological novelist; Tolstoy (1828–1910) (q.v.); Gontcharov (1812–91), the author of *Oblomov*; Pisemsky (1820–81); Grigorovitsh (1822–99); and Gorky (1868–) (q.v.). Among dramatists are: Griboyedov (1795–1829), Ostrovsky (1823–86), Alexei Tolstoy (1817–75), and Chekhov (1860–1904). The father of Russian literary criticism was Byelinsky (1810–48). Of the numerous recent Russian authors space permits us to mention only a few: Andreev, Artsybashev, Chirikov, Korolenko, Kuprin, Merezhkovsky, and Potapenko.—BIBLIOGRAPHY: S. A. Vengerov, *Biographic Dictionary of Russian Writers*; Pypin and Sparsovich, *History of Russian Literature*; P. Polevoy, *History of Russian Literature in Biographies and Essays*; M. de Vogüé, *The Russian Novel*; S. Persky, *Contemporary Russian Novelists*.

Music.—At the present time there is no more interesting group of composers than the Russian school, for their works possess in a remarkable degree originality, character, freshness of ideas, charm, and effectiveness for the medium for which they are written.

The history of Russian music may be said to commence with Michael Glinka (1804–57). In the century preceding Glinka's birth Italian music had been dominant throughout Europe. The beautiful and characteristic national music of Russia (which we can now study in the fine collections made by Balakirev and Rimsky-Korsakov) was utterly neglected, and was not revived until the great wave of patriotic enthusiasm following the Napoleonic invasion and retreat of 1812, and came to its own in the virile, characteristic work of Glinka. His famous opera *A Life for the Czar* became immensely popular, and opened the way for truer national ideals. The work was carried on with energy and enthusiasm in the next generation by a little group of very gifted composers: Balakirev (1837–1910), Borodin (1834–87), Cesar Cui (1835–1918), Moussorgsky (1839–81), and Rimsky-Korsakov (1844–1908). This group became known as 'The Five'; their ideals combined the characteristic beauties of Russian folk-song with the technical mastery of Western musical art. The splendid achievement of this group of composers, and especially that of Moussorgsky and Rimsky-Korsakov in opera, is now recognized as amongst the most important in the history of modern music.

The fine contemporary work of Tchaikovsky (1840–93), especially in the domain of symphony and orchestral writing, is now so well known that here we hardly need do more than record his sure place in Russian musical art.

Among the most distinguished successors of this brilliant company are Arensky (1861–1906) a pupil of Rimsky-Korsakov, a versatile composer who excelled in writing for orchestra, chamber music, and piano pieces. Glazounov (1865–), in whom we have a symphonist of the first order. A pupil of Rimsky-Korsakov, he succeeded his distinguished teacher as director of the Petrograd Conservatoire. Rebikov (1866–) has written much piano music of great interest and charm. Scriabin (1871–1915), one of the most discussed personalities of the present time, has written a large quantity of piano music, and several symphonic pieces for orchestra. Rachmaninov (1873–), one of the most gifted members of the younger Russian school, has distinguished himself in the triple capacity of composer, conductor, and pianist. Glière (1875–) has written some excellent chamber music, and many attractive and characteristic piano pieces.

History.—The early history of Russia is very obscure, but the Slavs or Russians were conquered by a body of Scandinavians known as Varangians, the first of whom was Rurik (862–879). The introduction of Christianity is attributed to Vladimir I (980–1015). In this Varangian period Russia was a federation of little states, Novgorod and Kiev being the two chief centres. Consolidation was effected by the Tatars, who first appeared in 1224, though their conquest under Batu Khan did not begin till 1238. They subdued all the little Slav states except the Republic of Novgorod; the princes of Moscow gained an ascendancy over the other states, and formed the nucleus of a central sovereignty. The Tatar supremacy lasted till about 1480, when Ivan III (1462–1505) succeeded in throwing off their yoke. He conquered Novgorod in 1478. The reign of Ivan IV 'The Terrible' (1533–84) is of great importance. In 1547 he assumed the title of Tsar. He conquered Kazan and Astrakhan, and began the conquest of Siberia. The accession of the House of Romanov took place in 1613, when the States-General elected Michael Romanov as ruler. He was succeeded by his son Alexei (1645–76) and by his grandson Feodor III (1676–82). On Feodor's death his brother, Ivan V, and his half-brother, Peter the Great, became joint-rulers. Peter was sole ruler from 1689 to 1725. He completed the conquest of Siberia, waged successful war with Charles XII of Sweden, and gained the territories on the east shore of the Baltic. He founded St. Petersburg in 1703, and made it the capital in place of Moscow.

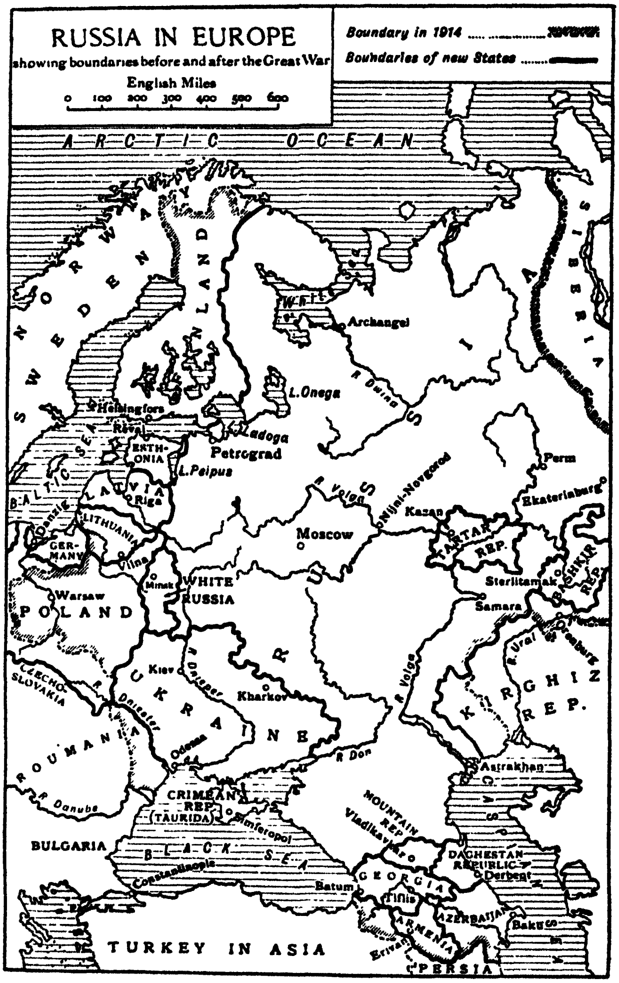
Peter the Great was succeeded by his wife, Catherine I (1725–7), after whom came Peter's grandson, Peter II (1727–30), Anna (1730–40), Ivan VI (1740–1), and Elizabeth (1741–62), daughter of Peter I. A part of Finland was obtained in 1743, and Russia took part against Prussia in the Seven Years' War. Peter III (1762) was deposed and murdered by his wife, Catherine II (1762–96). She added to the empire by the three partitions of Poland (1772, 1793, 1795), gave protection to Georgia (1783), and incorporated Courland (1795). The Crimea was freed from Turkey in 1774 and annexed by Russia in 1783.

In the Napoleonic period Russia took an important part in the general history of Europe. Catherine's son and successor, Paul I (1796–1801), joined the second coalition against Napoleon, and a Russian army operated with some success in Italy and Switzerland, but in 1800 Paul formed an alliance with Napoleon. He was murdered in 1801, and his son, Alexander I (1801–25), succeeded to the throne. Alexander joined Austria, and afterwards Prussia, against Napoleon. The battle of Eylau (1807) was drawn, but at Friedland, in the same year, Russia was heavily defeated. Alexander then concluded the Peace of Tilsit with Napoleon, but ultimately broke with him, and Napoleon made his disastrous march to Moscow in 1812. The Russians co-operated in the later operations against France, and by the Treaty of Vienna (1815) Poland was given to Russia as a subordinate kingdom. By the Treaty of Frederikshavn (1809) Finland was ceded by Sweden to Russia, but it kept its own Constitution. Georgia was fully incorporated with the empire in 1801. A war with Turkey, ended by the Treaty of Bucharest (1812), gained Bessarabia for Russia; and the Treaty of Tiflis (1813) deprived Persia of some territory in the Caucasus. Alexander began his reign with liberal measures, but subsequently he became more and more reactionary and despotic. The reign of his brother, Nicholas I (1825–55), was one of thorough reaction. Poland revolted in 1830, and was deprived of its Constitution. Nicholas co-operated with Britain and France at Navarino (1827), and by making war on Turkey (1828–9) assisted in freeing Greece. The Treaty of Adrianople (1829) gave Russia an accession of territory at the expense of Turkey. Further designs on Turkey led, in 1854, to the Crimean War (q.v.), but it was not concluded till after the accession of Alexander II. The Treaty of Paris (1856) neutralized the Black Sea and restored Bessarabia to the Porte. The reign of Alexander II (1855–81) is one of the most important in Russian history. Russia's failure in the Crimean War caused her rulers to turn their attention to home affairs, and to initiate a period of reform. The millions of serfs in the empire were liberated by the emancipation decree of 1861. The judicial system was reorganized on modern lines, and jury trial was introduced. An insurrection in Poland in 1863 led to the withdrawal of its separate government, and in 1868 Poland was completely incorporated with Russia. Compulsory military service became law in 1874. The government of the Baltic provinces was incorporated with that of Russia in 1876. The reforming energy of the Government was exhausted by about 1866, and fear of its own work caused it to adopt a reactionary policy. From this time Nihilism (q.v.) became a notable force in Russian politics, and its increasing strength led Alexander to make Loris Melikov practically dictator in 1880. Melikov recommended a policy of moderate reform, and Alexander was about to issue a decree calling an assembly of notables when he was assassinated in St. Petersburg in March, 1881. Alexander's reign witnessed a great advance of the empire in Central Asia and the Far East. Khiva and Bukhāra were made vassal states; Khokand, Tashkent, and Samarkand were conquered; and China ceded to Russia her present Amur and coast provinces on the Pacific and the northern half of Sakhalin, in addition to trading and other rights. The southern half of Sakhalin was obtained from Japan in 1875 in exchange for the Kurile Islands. Alaska was sold to the United States in 1867. In the three great Prussian wars of his reign Alexander maintained strict neutrality, but without concealing his friendliness to Prussia. He took advantage of the Franco-German War to free himself from the Black Sea clauses of the Treaty of Paris (1856). The Russo-

Turkish War of 1877–8 was partly the outcome of Pan-Slavism (q.v.). It led to the Treaty of Berlin (1878), under which Russia recovered Bessarabia. Alexander II was succeeded by his son, Alexander III (1881–94), who soon reversed his father's liberal policy. Press freedom disappeared completely, and the universities were again repressed. The powers of the *zemstvos* were severely restricted in 1890, and the direct representation of the peasants on them was abolished. The *dumas* were deprived of all real independence in 1892. Alexander II's judicial reforms were partly undone, and the village communities (*mirs*) were brought under the more direct control of the landowners. Russification was vigorously pursued in Poland and the Baltic Provinces, and in 1890 the first steps towards the Russification of Finland were taken. Alexander III was not friendly to Germany, but avoided hostilities more serious than those of a tariff war, although the Bulgarian crisis of 1885 subjected their relations to a severe strain. Russia and France now began to draw close together, but a Franco-Russian alliance was not officially admitted till 1896–7. Merv was annexed in 1884, and the occupation of Penjdeh in 1885 nearly led to war with Britain. Alexander III escaped several attempts at assassination, and died of disease in Nov., 1894.

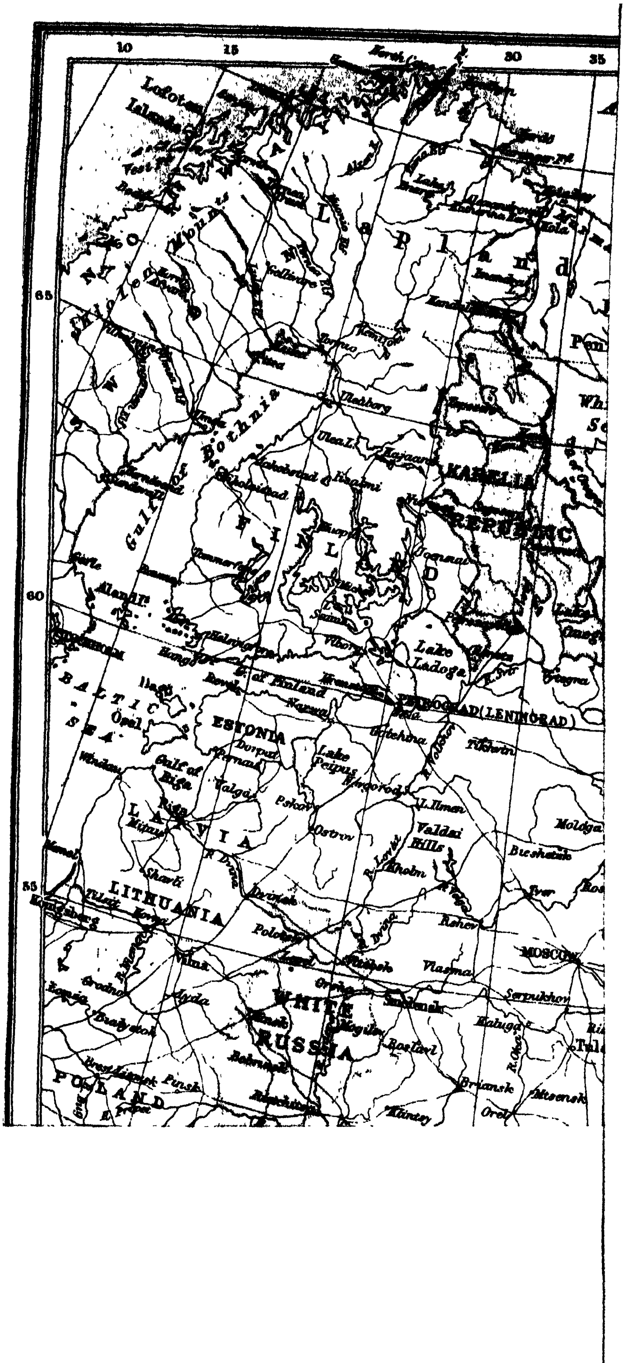
After the reign of Alexander III comes the fateful reign of his son, Nicholas II, the last of the Romanovs. In 1896 China granted permission to carry the Siberian Railway (begun in 1889) through Manchuria to the Far Eastern Russian seaport Vladivostok. In Dec., 1897, in consequence of the Germans having extorted Kiaochow from China, Russia occupied Port Arthur, and in the following year she obtained from China a lease of it and some neighbouring territory, although in 1895 she had taken the chief part in preventing Japan from taking it as a prize of victory. She shared in the international expedition to China in 1900, and herself suppressed risings in Manchuria with the utmost cruelty. Professing to be ready, and even anxious, to evacuate Manchuria as soon as possible, she was preparing for virtual annexation, but her aggressive action in Korea aroused Japan and led to the war of 1904–5. (See *Japan.*) By the Treaty of Portsmouth (New Hampshire, 1905), which ended this war, Russia lost all influence in Manchuria, Korea, and China, and had to cede to Japan Port Arthur and its territory, and also Southern Sakhalin. In 1898 the Tsar sent a proposal to all the Powers suggesting a conference on armaments, and the result was the notable Peace Conference at The Hague in 1899. The machinery created by this conference proved sufficient to settle peaceably the serious dispute with Britain which arose out of the firing of Russian warships on British fishing-vessels at the Dogger Bank in Oct., 1904. Nicholas II's internal policy was, on the whole, reactionary. Representatives of the *zemstvos* met in Nov., 1904, at the invitation of the Tsar, and formulated a programme of reforms. Similar demands were made by gatherings of professional men, and by working-class organizations. A great strike occurred in St. Petersburg, in Jan. 1905, and the strikers, led by a priest named Gapon, marched unarmed on Sunday, 22nd Jan., 1905, to present an address to the Tsar at the Winter Palace. The Tsar had fled to Tsarskoe Selo, and the crowd were shot down and sabred without mercy. This was followed by a period of disorder approaching chaos throughout European Russia. In Aug., 1905, the Tsar issued a manifesto ordering the election of an imperial representative Duma; in September Caucasia, and especially Baku, was the scene of terrible disorders, during which the oil industry suffered severely. Near the end of October a general railway strike rendered the autocracy almost powerless, and on 30th Oct. the Tsar was compelled to promise complete liberty and self-government. Count Witte became president of a reorganized Council of Ministers, with instructions to form a Reformist Cabinet. The general strike in Finland compelled the Tsar to restore Finland's Constitution and liberties. The bureaucrats attempted to discredit the reform movement by instigating attacks on Jews, and other outrages, especially in Odessa, where the authorities permitted appalling atrocities. The Imperial Duma, promised in 1905, was duly elected early in 1906, and held its first meeting on 10th May at St. Petersburg. It was dissolved later in the year because too liberal, and a second one, elected in 1907, met the same fate. By various devices the Government managed the election of a less advanced Duma late in 1907. The third Duma lasted till 1912, and a fourth Duma was elected which was in existence when the European War broke out. The demands of the Duma for reform became more and more definite. In July, 1914, street demonstrations and strikes became numerous. With the outbreak of the war the people rallied to the support of the Government, which promised concessions and reforms. These promises were never kept. On the contrary, in consequence of the successful Russian campaign in Galicia, the autocratic Government became more firm and stiff-necked.

In March, 1917, riots took place in Petrograd and other centres, and the troops began to join the revolutionaries. A Provisional Government was set up with Prince Lvov as Premier and Kerensky as Minister of Justice, and on 15th March the Tsar abdicated at Pskov. A *Council of Workmen's and Soldiers' Delegates* had been formed by the Petrograd mob, but in May a



coalition ministry took office (Lvov, Kerensky, and two Socialists). This ministry was pro-war. Kerensky became Premier in August, and in November a Bolshevik *coup d'état* was carried through in Petrograd, Lenin, with Trotsky as Foreign Minister, assuming control. The Bolsheviks demanded peace from Prince Leopold of Bavaria, and abjectly surrendered at Brest Litovsk. (For extent and development of Lenin's rule, see also section on *Constitution.*) The Constituent Assembly met in 1918, but the Bolsheviks, being a small minority, were defeated. They were in power, however, so the Assembly was dissolved and a period of terrorism, when the Red Guards overran the country, began. Events moved rapidly thereafter. The Brest Litovsk Treaty was ratified, the National Debt repudiated, capital transferred to Moscow, Tsar and imperial family murdered, and the Church disestablished and its property confiscated. The Reds invaded Siberia, the Ukraine, the Cossack territory, and the Baltic States, while Entente troops landed at Archangel and Murmansk (Aug., 1918). Anti-Bolshevik Governments had been organized in Siberia, the chief being that at Omsk, under the presidency of Admiral Koltchak. This was put down in 1919 and 1920, in spite of the able assistance of a Czechoslovakian force. In 1920, after the withdrawal of the British, Archangel was entered, the Ukraine, which had been an anti-Soviet state under German protection, was overrun by Reds, Wrangell was defeated in the Crimea, and Balahovitsh was defeated in White Russia. Meantime Russia had been organized on the most extreme principles of socialism and class-hatred, and a veritable reign of terror was in progress. In Dec., 1920, an Agrarian Law compelled the peasants to give to the State all agricultural produce which they did not themselves require. Early in 1921, however, a series of strikes and a seamen's mutiny at Kronstadt made it clear that a complete reversion of economic policy was necessary. Therefore concessions were granted to capitalists, peasants were allowed to barter and sell grain (but had to pay taxes), private ownership of land was recognized, and private trading was allowed. Foreign trade now began to revive. At this time the Bolshevists got a firm hold on Persia, Afghanistan, and China, several Soviet states were founded in Siberia, Georgia was occupied, and Armenia and Azerbaijan became Soviet Republics.

In 1922 the necessity of increasing production and trade led many leading Bolsheviks to recommend the denationalization of industry. For the purpose of attracting foreign capital and fostering trade a Russian delegation attended the conferences at Genoa and The Hague, but with no positive results beyond the Rapallo Treaty establishing trade relations with Germany. Russians were also present at Lausanne (1922, 1923) to discuss the Straits question. In 1922 Russian influence in the Far East continued to advance, and Red forces occupied Vladivostok, which, with Japanese help, had held out. At


10
15
20
30
35
65
60
55
North Cape
Lofoten Islands
Vest Fd.
Bodö
L a p l a n d
Alexandrovsk
Kola
Lake Enare
Kandalaksha
Kem
Pen
Wh
Se
KARELIA
REPUBLIC
N O R W A Y
Kjolen Mounts
Gellivare
Tornio
Uleaborg
Ulea L.
Kajaani
Gulf of Bothnia
Jakobstad
Kuopio
Joensuu
Petrozavodsk
F I N L A N D
Lake Ladoga
Viborg
Helsingfors
Hangö
Tammerfors
Åland Is.
STOCKHOLM
G. of Finland
Reval
Narva
Kronstadt
PETROGRAD (LENINGRAD)
R. Svir
Vytegra
Onega
Gatchina
Tikhvin
B A L T I C S E A
Ösel
ESTONIA
Dorpat
Pernau
Lake Peipus
Novgorod
L. Ilmen
R. Volkhov
Windau
Gulf of Riga
Riga
Valga
Pskov
L A T V I A
Mitau
Ostrov
Valdai Hills
Mológa
Bieshetsk
Memel
Shavli
R. Dvina
R. Lovat
Kholm
R. Volga
Tver
LITHUANIA
Tilsit
Königsberg
Kovno
Dvinsk
Polotsk
Rzhev
MOSCOW
R. Niemen
Vilna
Vitebsk
Vlasma
Grodno
Lomza
Lyda
Orsha
Smolensk
Serpukhov
Bialystok
WHITE RUSSIA
Minsk
Mogilev
Roslavl
Kaluga
R. Oka
Tula
Brest Litovsk
Pinsk
Bobruisk
Briansk
Mtsensk
P O L A N D
R. Pripet
Rechitsa
Klintsy
Orel

this time the *Tcheka*, now known as the *Ogpu* (a red inquisition founded in 1917 by Dshershinsky), was really in power. Conscription was introduced in 1922, the Union of Soviets (see above) was formed, and there was severe Church persecution. In 1923 trade with Britain revived considerably, and in 1924 the Soviet Government was recognized *de jure* by the British Government. Lenin died in 1924 and was succeeded by Rykov, though the real power was in the hands of Kamenev, Zinoviev, and Stalin. In 1924 Trotsky, who was Commissary for war, fell into disfavour, and in 1925 was removed from office. He was exiled in the Caucasus but soon returned, and in 1926 he and other discredited leaders (notably Radek and Zinoviev) commenced a campaign of opposition to Stalin, who succeeded Rykov. This dissension in the Bolshevist camp was all the more grave coming, as it did, at a time when the Russian Government was beginning to recognize that Bolshevism in its entirety was unworkable. In 1925 Krassin became Soviet representative in Britain; a post which he held till his death in 1926. In 1925 and 1926 Soviet intrigue was active in China and Central Asia, and the Moscow Government actively supported the Cantonese (Southern) forces in the Chinese civil war. For maps see coloured maps of *Europe* and *Asia*.—BIBLIOGRAPHY: *Soviet Russia* (a descriptive booklet issued by H.M. Stationery Office); Segal and Santalov, *Commercial Year Book of the Soviet Union*; A. MacCallum Scott, *Beyond the Baltic*; Mrs. Philip Snowden, *Through Bolshevik Russia*; S. N. Prokopovich, *The Economic Condition of Soviet Russia*; W. R. Morfill, *Russia* (The Story of the Nations); *The Russian Empire* (*Peace Handbook*, vol. ix, issued by H.M. Stationery Office) deals with the geography, politics, and political history and economics of Russia up till the Revolution, and is furnished with bibliographical references.

Russia Leather is prepared chiefly from cowhides tanned with willow, poplar, and larch bark, and is saturated with birch-bark oil, which gives it its peculiar odour. Being strong, and proof against water and insects, it is much used for bookbindings, hand-bags, and fancy articles.

Rust, the reddish-brown scale of hydrated ferric oxide (see *Iron*) formed on iron exposed to the air. The first coating of oxide does not protect the iron from further oxidation; it is otherwise with copper or zinc. Rusting is prevented by coating the surface with some protecting material, vaseline or black-lead for small articles, tin or zinc for sheets (see *Galvanized Iron*); certain paints and oils are also used.

Rustchuk, Ruschuk, or **Russé**, a town of Bulgaria, capital of the department of Russé, on the Danube, opposite Giurgevo; served by railway direct to Varna. Rustchuk is the chief Bulgarian port on the Danube, having exports and imports of cereals, flour, tobacco, and carpets. Soap, pottery, earthenware, and cement are manufactured. Rustchuk is of considerable strategic importance, but the fortifications were almost destroyed by Russian bombardment in 1877–8, and were dismantled by order of the Congress of Berlin. Pop. (1921), 41,570 (about 9000 being Turks).

Ruta′ceæ, a natural order of polypetalous dicotyledons. They are shrubs or trees, rarely herbs, the simple or compound leaves dotted with glands, often having a strong heavy smell. About 700 species are known, occurring most abundantly in Australia and South Africa.

Ruth, Book of, a canonical book of the Old Testament. The date of the history and the name of its writer are unknown, but it is probably of a date subsequent to the captivity.

Ruthenia (Carpathian Ruthenia), a province of Czecho-Slovakia formerly known as Hungarian Ruthenia, mainly inhabited by Ruthenes. It includes, roughly, the former Hungarian counties of Máramaros, Bereg, and Ugocsa, and is bounded on the north-east by the Carpathians from 47° 58″ to 49° N. lat., on the south by Transylvania, and on the south-west by Hungary. *Physiography.*—Máramaros and north-eastern Bereg are mountainous. The rivers flow in a south-westerly direction to join the Theiss, or its tributary the Vissó; in Bereg the Latorcza is the principal tributary. Eastern Ruthenia is a land of narrow valleys and torrential streams. The typical alluvial and loess soils of the Alföld (Central Hungarian Plain) are represented in Ugocsa and south-west Bereg. *Production.*—Gold and silver, copper, and lead are found in the Carpathians; rock-salt is also worked in the submontane regions. Maize, wheat, oats, rye, and barley are the chief cereal crops. There is some forestry. *Towns.*—The chief towns are Munkačevo and Užhorod. Area, 4903 sq. miles; pop. (1921), 605,731.

Ruthe′nians, Russin′ians, Russniaks, Red or Little Russians, a term applied to the Slavonic tribes inhabiting the former Austro-Hungarian Empire, i.e. Eastern Galicia, Bukowina, and North-Eastern Hungary, and also the east of Czecho-Slovakia, and the Kolomea district in Poland. The total number of Ruthenians amounts to 3,800,000. They live almost exclusively by agriculture, and their state of civilization is still very low. They belong for the most part to the United Greek Church, and in politics their Russian proclivities made them a disruptive force which helped in breaking up the former Austro-Hungarian Empire.

Ruthe′nium, one of the platinum metals. It closely resembles platinum, and is usually found in association with this metal. It is a hard, white metal, with specific gravity 12·3, and is not readily fusible. Symbol, Ru; atomic weight, 101·7.

Rutherford, Sir Ernest, British physicist, was born in New Zealand in 1871. In 1894 he won a science scholarship, with which he proceeded to Cambridge, entering Trinity College and carrying on research work at the Cavendish laboratory. In 1898 he went to Canada as professor of physics in M'Gill University, where he began his investigations on radio-activity. These were continued at Manchester, whither he was transferred in 1907. Rutherford was elected F.R.S. in 1903, knighted in 1914, and appointed to the Cavendish chair of experimental physics at Cambridge in 1919. He was awarded the Rumford Medal in 1905, and the Nobel Prize for chemistry in 1908. Besides many memoirs, chiefly relating to atomic structure and disintegration, and conduction of electricity in gases, he has published *Radioactivity*, *Radioactive Transformations*, *Radioactive Substances and their Radiations*.

Rutherford, or **Rutherfurd,** Samuel, Scottish divine, born about 1600, died 1661. He took a prominent part in the drawing up of the National Covenant. In 1639 he became professor of divinity, and in 1649 principal of the new college, St. Andrews. He published numerous politico-theological treatises. The most famous of these is *Lex Rex*, which on the Restoration was publicly burned. His *Familiar Letters*, published after his death, have been frequently reprinted.

Ruth′erglen, a royal and municipal burgh of Scotland, in the county of Lanark, 2 miles southeast of Glasgow, on the left bank of the Clyde; served by the Caledonian Railway and by tram from Glasgow. There are chemical-works and dye-works, a paper-mill, a pottery, a building-yard for small steamers; and in the vicinity coal-mines. Rutherglen was erected into a royal burgh by David I about 1126. Pop. (1921), 24,700.

Ruthin, Rhuddin, or **Rhuthyn,** a municipal borough of Denbighshire, North Wales, on the Clwyd. Near it are the remains of a magnificent old castle called Rhyddin, or Red Fortress. Pop. (1921), 2770.

Ruthven, Raid of, in Scottish history, an act of treachery by which the Earl of Gowrie and his party, in 1582, secured for ten months control over the person of James VI, then only sixteen years of age. The young king was set free by the opposition party, and the Earl of Gowrie was beheaded.

Rutile, a hard mineral, usually reddish, consisting of titanium dioxide crystallized in the tetragonal system. Its high specific gravity (4·2) causes it to accumulate in alluvial sands; it is the chief source of titanium. It is abundant in microscopic crystals in granitoid rocks.

Rutland, or **Rutlandshire,** the smallest of the English counties, surrounded by the counties of Lincoln, Leicester, and Northampton; area, 152 sq. miles. It is traversed by the Midland and the London & North-Western Railways. The county is devoted mainly to hunting and to agriculture, and is famous for its sheep, wheat, and cheese, much of the latter being sold as Stilton. The county town is Oakham. Pop. (1921), 18,368.

Ruwenzori, a great mountain massif of Central Africa, running N.N.E. and S.S.W. for about 70 miles between Lake Edward to the south and Lake Albert to the north, with a greatest breadth of 30 miles, and forming a portion of the boundary between the Protectorate of Uganda and the Belgian Congo. Ruwenzori drains entirely into Lake Albert. It rises in its highest peak to an altitude of 16,815 feet. The snow peaks embrace an area of 55 sq. miles. The glaciers are comparatively small and do not descend below 14,700 feet altitude, which is the permanent snow-line. The striking feature about them is their existence in a latitude less than half a degree north of the equator. Ruwenzori is seldom visible during the dry seasons, being usually enveloped in a dense haze. When Stanley discovered Lake Edward in 1875 he failed to pierce this mist, and it was not until he returned with the Emin Relief Expedition of 1888 that he was rewarded by being the first European to see Ruwenzori. In 1906 the Duke of the Abruzzi passed six weeks in exploring the snow-capped peaks, and by this means a comprehensive map was produced for the first time. Some attempts have been made to identify Ruwenzori with Ptolemy's 'Mountains of the Moon', which were supposed to feed the Central African (Nile) lakes from their snowy wastes, but this hypothesis is not generally accepted. See *Uganda*; *Toro*; *Nile*; *Semliki*; *Rudolph, Lake*; &c.—BIBLIOGRAPHY: Sir H. M. Stanley, *In Darkest Africa*; D. W. Freshfield, *Towards Ruwenzori*; H.R.H. The Duke of the Abruzzi, *The Snows of the Nile* (in *Geographical Journal*, vol. xxix, 1907, with map).

Ruysdaal (rois′dȧl), or **Ruysdael,** Jacob van, Dutch painter, born at Haarlem probably about 1625, died in the poorhouse of his native place 1682. His paintings, but little appreciated during his lifetime, are now highly valued. Fine examples are to be seen in the National Gallery at London, and in the Louvre at Paris. Landscapes with dark clouds hanging over them, or lakes and rivulets surrounded by overhanging trees, are his subjects.

Ry′an, Loch, an arm of the sea, on the north-west of Wigtownshire, Scotland, extending inland about 9 miles, varying from 2 to 4 miles in breadth, and affording safe anchorage. At the head of the loch lies Stranraer.

Ryde, a municipal borough and watering-place of England, opposite Spithead, on the north-east coast of the Isle of Wight. It is the northern terminus of the Isle of Wight Railway, and is served by steamers to Portsmouth, Southsea, Portsea, Stokes Bay, Cowes, and Southampton. It is the largest town in the island. Pop. 10,700.

Rye (*Secāle cereāle*, nat. ord. Gramineæ), an esculent grain bearing naked seeds on a flat ear, with awns like barley. It is a native of the Levant. It thrives in climates and in soils which forbid wheat; requires less manure, and ripens faster. It is extensively grown in Northern Europe, and rye bread is the chief food of the labouring classes in many parts of Russia, Sweden, Norway, Denmark, Holland, and Prussia. The grain is used in the manufacture of Hollands gin. The straw is long and flexible, and is used by brick-makers and thatchers, also for stuffing horse-collars, &c., and for making baskets and straw hats. Rye is subject to a disease called ergot, which renders it dangerous for food. See *Ergot*.

Rye, a municipal borough of England, in the county of Sussex, one of the Cinque Ports, on the River Rother. The town is very ancient. In Roman times it was surrounded by the sea. Pop. (1921), 3920.

Rye-grass, the common name of a number of species of the genus Lolium, a genus which includes not only some of the most useful grasses, but also some of the most noxious weeds. These grasses are readily known by the many-flowered sessile spikelets, arranged edgewise and alternately upon a zigzag rachis. The useful species are the *Lolium perenne* and the *Lolium Italicum* or Italian rye-grass. The weeds are the *L. temulentum*, or common darnel (q.v.), and its allies.

Rye-house Plot, in English history, a conspiracy, planned in 1683, the immediate object of which was to assassinate Charles II and his brother, the Duke of York (afterwards James II), as they returned from the Newmarket races. The plot failed owing to the king and his brother happening to return from Newmarket earlier than was expected. The detection of the plot led to the arrest on a charge of high treason of William, Lord Russell, Lord Essex, and Algernon Sidney, who were in no way connected with it. Essex put an end to his own life in the Tower, while Russell and Sidney were beheaded, as also Lieutenant-Colonel Walcot, one of the real contrivers of the plot.

Rymer, Thomas, English critic and antiquary, born 1641, died 1713. As Historiographer Royal, he was entrusted by the Government with the task of making a collection of public treaties from the year 1101, which he began to publish in 1704. He completed fifteen volumes, and five more were afterwards added by Robert Sanderson. This work, usually referred to as Rymer's *Fœdera*, is a valuable source of history for the period it covers.

Ryukyu, or **Luchu Islands**, a Japanese festoon of fifty-five islands extending between Kyushu and Taiwan (Formosa). Area, 941 sq. miles; pop. 500,000.

S

S, the nineteenth letter of the English alphabet, representing the hissing sound produced by emitting the breath between the roof of the mouth and the tip of the tongue placed just above the upper teeth. From this circumstance it has sometimes been reckoned among the linguals (as the tongue is essential in its pronunciation), sometimes among the dentals (as the teeth co-operate in producing the hissing sound). More descriptively it is classed as a *sibilant*. It has a twofold pronunciation —sharp or hard, as in *sack*, *sin*, *this*, *thus*; and soft or sonant (when it is equivalent to *z*), as in *muse*, *wise*.

Saale (zä′lė), the name of several German rivers, the most important of which is that which rises on the north side of the Fichtelgebirge, in the north-east of Bavaria, and joins the Elbe after a course of about 220 miles. It passes the towns Hof, Jena, Naumburg, Merseburg, and Halle, and is of great commercial importance. It is partially canalized.

Saar, a river of France, Germany, and the 'Saar Valley', a right-bank tributary of the Moselle, rises in the Vosges Mountains, in the French department of Bas-Rhin, and joins the Moselle at Konz after a course of 150 miles. It passes through the Saar coal-fields, which are served by the Saar Canal, joining the river at Sarreguemines, and communicating with the Rhine-Marne Canal at Gondrexange.

Saarbruck, a town of the Saar Valley area, of which it is the seat of the Commission (see *Saar Valley*) and the administrative centre. It stands on the left bank of the Saar, and is served by the main railway line running north-east between Metz and Bingen (for Mayence), and by a direct line to Ludwigshafen and the Rhine. The town is the centre of the Saar coal- and iron-fields. Pop. 105,000.

Saargemünd. See *Sarreguemines.*

Saarlouis, a town of the Saar Basin, on the Saar, 40 miles south of Trèves, on the Saarbruck-Trèves railway line. Pop. 8000.

Saar Valley, a district of Europe, lying between the French department of Moselle and the detached South German enclave of Oldenburg, which, in accordance with the Treaty of Versailles (28th June, 1919), will be governed for fifteen years, ending in 1934, by a Commission of five members appointed annually by the League of Nations. The Commission sits at Saarbruck, and comprises one French member, one chosen from the Saar population, and three others of any nationality excepting French or German. In 1934–5 a *plébiscite* will be taken, with three courses open: (1) maintenance of the *status quo,* (2) union with France, (3) union with Germany. The great value of the Saar Basin lies in its extensive coal-field, the exclusive exploitation of which (excepting the mine at Frankenholz) was granted to France by Article 45 of the Treaty of Versailles, by way of compensation for the war-time destruction of the mines of Northern France. Before the European War the Saar coal-field was the State-operated property of Germany and Bavaria (Palatinate), and the value of the mines is written up against the Allied reparations account. The total reserves of coal above the 6000-feet level are estimated at 16,500,000,000 tons, extending over an area of 520,000 acres; 9,410,443 tons were produced in 1920. The Saar coal is of inferior quality. Iron and steel industries and some pottery and ceramic art industries rank next in order of importance. The chief towns are Saarbruck, Volklingen, Saarlouis, Dillingen, and Merzig, all in the valley; Neunkirchen is an industrial centre; Sulzbach, Dudweiler, and Friedrichsthal are mining communities. Area of the Saar Basin, 751 sq. miles; pop. 660,000 (approximately).

Saba, a small Dutch West Indian island, governed as a dependency of Curaçao. It consists of a single volcano cone, furrowed by deep, wooded, and fertile valleys, producing sugar, cotton, coffee, and indigo. Area, 5 sq. miles; pop. (1921), 1670.

Sabadell′, a manufacturing town of Spain, in the province of Barcelona, on the River Ripoll. Wool and cotton spinning and weaving are chiefly carried on. Pop. 23,000.

Sabadil′la, Cebadilla, or **Cevadilla,** the dried ripe seeds of *Schœnocaulon officinale* (*Asagrœa officinalis* of Lindley), a plant of the lily family growing in Mexico and Central America. The seeds are long, blackish-brown outside, white inside, of an acrid and burning taste, but without smell. Sabadilla powder is used as a vermifuge. See *Veratrine.*

Sabbath (a Hebrew word signifying rest), is the day appointed by the Mosaic law for a total cessation from labour, and for the service of God, in memory of the circumstance that God, having created the world in six days, rested on the seventh. Sabbath is not strictly synonymous with Sunday. Sunday is the mere name of the day; Sabbath is the name of the institution. Sunday is the Sabbath of Christians; Saturday is the Sabbath of the Jews and some minor Christian sects. The first notice in the Old Testament pointing to the Sabbath occurs in *Gen.* ii, 2, 3; but the first formal institution of the day as a holy day and a day of rest is recorded in *Exod.* xvi, 22–26, on the occasion of the children of Israel gathering manna in the wilderness. The Sabbath began at sunset on Friday and ended at sunset on Saturday. On the Sabbath the Jews were not allowed to go out of the city farther than 2000 paces, that is, about a mile, and this distance was called a *Sabbath-day's journey.* In the Gospels the references to the Sabbath are numerous, and they show us that Christ always paid respect to the institution although He did not regard the minute prohibitions that had been added to the original law. The desire of distinguishing the Christian from the Jewish observance early gave rise to the celebration of Sunday, the first day of the week, instead of the Sabbath. In A.D. 366 the Council of Laodicea removed all scruples as to the duty of Christians to keep the Jewish Sabbath.

Sabbatical Year.—As every seventh day was a day of rest to the people, so was every seventh year to the land. It was unlawful in this year to plough or sow, or prune vines; and if the earth brought forth anything of its own accord, these spontaneous fruits did not belong to the master of the ground, but were common to all. This year was called the *Sabbatical year,* and was also to be a year of release for Jewish debtors.

Sabellius, a Christian teacher at Ptolemais, in Upper Egypt, who lived about 250, and is known as the founder of a sect who considered the Son and Holy Ghost only as different manifestations of the Godhead, but not as separate persons. He taught that as man, though composed of body and soul, is but one person, so God, though He is Father, Son, and Holy Ghost, is but one person. Pope Dionysius condemned him in a council held at Rome in 263.

Sabicu′, or **Savicu′,** a leguminous tree, *Lysiloma Sabicu,* native of Cuba. It furnishes an exceedingly heavy and hard wood, with a texture as smooth, close, and firm as ivory almost, and of a rich, warm, red colour.

Sab′ine, Sir Edward, British astronomer and physicist, born 1788, died 1883. He accompanied Sir J. Ross, and afterwards Sir E. Parry, in search of the North-West Passage, made valuable observations, and collected numerous data regarding the length of the pendulum and the variations of the magnetic needle. From 1861 to 1871 he was president of the Royal Society.

Sab'ine, a river of the United States. It rises in the north-eastern part of Texas, and after a course of some 500 miles flows into the Gulf of Mexico through Sabine Lake. It is too shallow to be of much use for navigation.

Sab'ines, or **Sabini**, an ancient people widely spread in Middle Italy, allied to the Latins, and already an important nation prior to the foundation of Rome. Originally they were confined to the mountain districts to the north-east of Rome, and their ancient capital was Amiternum, near the modern Aquila. As an independent nation they ceased to exist in 290 B.C., when they were incorporated with the Roman state. See *Rome* (*History*).

Sable, a digitigrade carnivorous mammal, nearly allied to the common marten and pine marten, the *Mustēla zibellīna*, found chiefly in Siberia and Kamchatka, and hunted for its fur. Its length, exclusive of the tail, is about 18 inches. Its fur is generally brown, greyish-yellow on the throat, and with small greyish-yellow spots scattered on the sides of the neck. Two other species of sable are enumerated, the Japanese sable (*M. melanŏpus*) and a North American species (*M. leucŏpus*). The Tatar sable (*M. siberica*) is a species of weasel found in Northern Russia and Siberia, and the pekan (*M. canadensis*) of North America is sometimes known as the Hudson Bay sable. The skins of all these varieties are frequently dyed and otherwise manipulated to imitate the true Russian sable. Sable hair is used in the manufacture of artists' pencils.

Sable (*Mustēla zibellīna*)

Sable Island, a low sandy island in the Atlantic, off the east coast of Nova Scotia, 20 miles long and 1 to 5 miles broad, with two lighthouses, life-saving stations, &c. Many shipwrecks have occurred on it. It is now planted with trees.

Sables (sä-bl), or **Sables d'Olonne**, a seaport and watering-place of France, in the department of Vendée, on the Atlantic. It has a good harbour, valuable fisheries of oysters and sardines, and a considerable trade. Pop. 14,000.

Sacbut, or **Sackbut**, a musical instrument of the trumpet kind with a slide; in fact an old variety of trombone (q.v.). The instrument called *sabbeka* in the Hebrew Scriptures was a stringed instrument.

Sacch'arates. See *Sucrates*.

Sacch'arides, a class of organic compounds. The carbohydrates include sugars, starches, and celluloses; and these are divided broadly into *monosaccharides*, sugars of the type of glucose; *disaccharides*, sugars of the type of cane-sugar; *trisaccharides*; and *polysaccharides*, the starches and celluloses. See *Sugar*; *Starch*; *Cellulose*.

Saccharim'eter, a polarimeter adapted for the determination of the strength of sugar solutions. A solution of sugar has the property of rotating the plane of polarization (q.v.) of light, the amount of rotation being proportional to the concentration of the solution. The instrument consists essentially of a horizontal tube, closed at both ends by glass caps, and placed between two Nicol prisms. The rays emerging from the first prism, the 'polarizer', will also pass through the second prism, the 'analyser', if the latter is placed in such a position that its crystalline faces are parallel to the corresponding ones of the first prism. If, however, the second prism is rotated, less and less light is transmitted, until, when the two are situated at right angles to one another, the light is totally extinguished. The prisms are then said to be 'crossed'. If a solution of sugar is now introduced into the cylinder, a certain amount of light will be transmitted, and the second prism will have to be rotated through an angle in order to cause complete extinction. The scale of the saccharimeter is graduated so that the percentage of sugar can then be read off directly. In Laurent's 'half-shade' saccharimeter, the field of vision is divided into two halves which are unequally illuminated when a sugar solution is interposed between the prisms. By rotating the analyser, equality of shade or tint may be again restored. This transition point can only be satisfactorily observed if monochromatic light, such as that produced by a sodium flame, is used. In another type of instrument the rotation of the sugar solution is neutralized by introducing into the field the required thickness of quartz of opposite rotatory power.

In addition to sugar, a very large number of chemical compounds of organic origin are optically active, i.e. rotate the plane of polarization of light. It was largely due to the study of this property that the chemical constitution and internal structure of these substances was elucidated. See *Stereo-chemistry.*

Sacch'arine, a benzene derivative containing sulphur and nitrogen, prepared from toluene, and introduced into commerce in 1887 by its discoverer, Fahlberg. Although totally different chemically from the sugars, it possesses an excessively sweet taste, and is largely used as a substitute for sugar; it is said to be 300 times sweeter than cane-sugar. It crystallizes in long flat plates, melts at 224° C., is sparingly soluble in cold water, and more readily in alcohol. It cannot be fermented, and is used as a substitute for cane-sugar by persons suffering from diabetes. It has no nutritive properties like sugar, and its use is held by some authorities to be injurious. Since 1918 saccharine has been manufactured in Britain. The quality demanded by British control must contain 95 per cent benzoyl-sulphone-imide; uncontrolled foreign saccharine contains a much lower percentage. The saccharine of commerce is the sodium salt; it is more soluble in water than pure saccharine.

Sac'copharynx, or **Eurypharynx**, a genus of eels, family Murænidæ. The best-known species (*S. pelecanoides* or *Eurypharynx pelecanoides*) was discovered comparatively recently. It inhabits the depths of the Atlantic, is of a perfectly black colour, is sometimes 9 feet in length, and but seldom met with. It owes its name to its pouch-like pharynx, which enables it to swallow other fish of large dimensions. The muscular system is but little developed, and the bones are thin and soft.

Sacheverell (sa-shev'ėr-el), Henry, English divine and controversialist, born 1674, died 1724. In 1709, while preacher at St. Saviour's, Southwark, he delivered two bitter sermons against dissent, and accused the existing Whig ministry of jeopardizing the safety of the Church. He was impeached in the House of Commons, tried in the spring of 1710, and suspended for three years. This persecution secured him at once the character of a martyr, and as soon as his suspension expired, Queen Anne presented him to the rich living of St. Andrew's, Holborn. Sacheverell, having no merit to keep him permanently before the public, now fell back into obscurity.

Sachs (zȧks), Hans, German poet and dramatist, the most distinguished meistersinger of Germany in the sixteenth century, born at Nürnberg in 1494, died in the same city 1576. An enthusiastic admirer of the Minnesingers, he took lessons under one of the chief meistersingers of Nürnberg, and began to write verses. In this he soon surpassed all his contemporaries. Thousands of verses flowed from his fertile brain, crude, but full of imagery and humour. As a staunch follower of Luther, and an ardent advocate of his teachings, Sachs succeeded in imparting to his hymns a fervour which considerably aided the spread of the Reformation.

Sackville, Thomas, Lord Buckhurst and Earl of Dorset, English statesman and poet, son of Sir Richard Sackville of Buckhurst, born 1536, died 1608. At Oxford and Cambridge he distinguished himself by his Latin and English poetry, and as a student of the Inner Temple he wrote, in conjunction with Thomas Norton, the tragedy of *Gorboduc*, or *Ferrex and Porrex* (first acted in 1561), the first example in English of regular tragedy in blank verse. His other works include *The Mirror of Magistrates*, and the *Complaint of Henry, Duke of Buckingham.*

Saco, a city of Maine, United States, in York county, on the Saco River. The river supplies water-power to local cotton-mills, shoe-factories, and machine-shops. Pop. 7000.

Sacrament (Lat. *sacramentum*), a pledge, an oath, in particular the military oath of allegiance. The word *sacrament* received a religious sense, in the Christian Church, from its having been used in the *Vulgate* to translate the Greek *mystērion*, a mystery. Among the early Latin ecclesiastical writers *sacramentum*, therefore, signifies a mystery, a symbolical religious ceremony, and was most frequently applied by them to the rite of baptism. In modern Christian theology sacrament is defined as an outward and visible sign of an inward and spiritual grace, a solemn religious ceremony enjoined by Christ to be observed by His followers, and by which their special relation to Him is created, or their obligations to Him renewed and ratified. In early times the Church had numerous sacraments, as many as thirty being enumerated in the first half of the twelfth century. The Roman and Greek Churches now recognize seven sacraments: baptism, confirmation, the eucharist, penance, extreme unction, orders, and marriage. Protestants in general hold baptism and the eucharist to be the only sacraments.

Sacramen'to, a river of the United States, in California. It rises in the Sierra Nevada, on the borders of Oregon, and drains the Great Valley of California from the north. Its course is about 500 miles, 261 (as far as Red Bluff) of which are navigable for small steamers (2 to 2½ feet draught). It discharges its waters into the Suisun arm of the Bay of San Francisco.

Sacramento, a city of California, United

States, the capital of the state, on Sacramento River; served by the Southern Pacific and the Western Pacific Railways, and by steamships to San Francisco. It occupies a low and level site on the flood plain of the Sacramento and American Rivers, and vast sums of money have been spent for levees, and in raising the street levels, so as to secure the town against inundation by the river. Sacramento owes its origin and prosperity to its situation in the rich grain- and fruit-producing Sacramento Valley, along the eastern side of which range the gold-producing counties of the state. Tobacco, leather goods, canned vegetables, fruit, and meats, and lumber are the chief manufactures. Settled in 1839, it became the state capital in 1854, and was chartered as a city in 1863. Pop. (1920), 65,860.

Sacred Heart of Jesus, a festival of the Roman Catholic Church celebrated on the Friday after the octave of Corpus Christi. The festival was introduced into the general calendar of the Church by Pius IX in 1856.

Sacrifices, gifts offered with some symbolic intent to the Deity, generally an immolated victim or an offering of any other kind laid on an altar and consumed in the service of the Deity. The symbolic character of sacrifice may be represented under three heads: (1) propitiatory, or designed to conciliate generally the favour of the Deity; (2) eucharistic, or symbolical of gratitude for favours received; (3) expiatory, or offered in atonement for particular offences. To a different class may be assigned deprecatory sacrifices designed to avert the wrath or appease the wicked disposition of deities. The customs of the Jews regarding sacrifice are given in detail in the *Book of Leviticus.* Few religions, whether ancient or modern, have omitted sacrifices from among their rites. The ancestors of all the existing races in Europe practised human sacrifices, and similar usages widely prevailed throughout the world. Among Christians the Roman Catholic and Greek Churches regard the Mass as a mysterious sacrifice; but with Protestants it is not generally so regarded.—BIBLIOGRAPHY: E. B. Tylor, *Primitive Culture*; W. R. Smith, *Lectures on the Religion of the Semites*; Sir J. G. Frazer, *The Golden Bough.*

Sa′crum, in anatomy, the bony structure which forms the basis of the vertebral column. The human sacrum forms the back part of the pelvis, is roughly triangular in shape, consists of five united vertebræ, and from its solidity is well adapted to serve as the keystone of the pelvic arch, being wedged in between and articulating with the haunch-bones. The lower surface articulates with another series of much smaller bones, usually four in number, united to form the coccyx in which the vertebral column terminates. In most mammals the number of vertebræ forming the sacrum is smaller than in man. In birds the lowest number is about ten. Fishes possess no sacrum at all. The sacrum in man is fully ossified and completed in development from the twenty-fifth to the thirtieth year of life, but the component parts can generally be perceived even in the most aged individuals. See *Pelvis.*

Sacy (sȧ-sē), **Antoine Isaac, Baron Silvestre de,** French philologist, born in Paris 1758, died 1838. He was professor of Persian at the Collège de France. His teaching gave a powerful impetus to the study of Oriental languages in Europe.

Saddle. The use of saddles on riding-horses was unknown to the ancient Egyptians, who merely covered the animal's back with a cloth; the Greeks of Xenophon's day did the same, or frequently rode bare-backed. Stirrups did not come into use before about A.D. 600, the rider either mounting from an elevation or else vaulting to his seat, sometimes with the assistance of a spear. In England the Sadlers' Company received its charter from Edward I, and thenceforward the trade of saddle-making grew in importance. The mediæval saddle was a cumbrous structure, with peaks at both front and rear; when intended for use in combat, it was substantially 'armoured' to protect the horseman's legs. The modern saddle has a skeleton or 'tree' of beech, covered with canvas and strengthened with steel. Its stuffing demands great nicety and attention if the horse is to carry its rider with comfort. The covering leather should be pig-skin; sheep-skin, a cheaper substitute, is of inferior wearing quality. The ordinary riding-saddle differs from that used by cavalry, while variations of weight and shape are seen in hunting- and racing-saddles.

Saddleworth, an urban district and town of Yorkshire (West Riding), England, on the Tame; served by the London & North-Western Railway and the Huddersfield Canal. Woollen goods are manufactured. The district is rich in antiquities of Druidical times. Pop. (1921), 12,570.

Sad′ducees, one of the two chief sects or parties existing among the Jews in the time of Christ. Various accounts are given of their origin. Some critics recognize in the Sadducees the descendants and adherents of the Zadok mentioned in *1 Kings,* i, 39. For the knowledge we possess about them we are indebted to the New Testament and to Josephus, a Pharisee. According to the latter the Sadducees did not believe in the immortality of the soul, and maintained that man's fortunes depended entirely upon his conduct. They also repudiated the oral law, and disbelieved in the existence of angels and spirits. They were a less numerous, but more aristocratic party than the Pharisees; possessed the largest share of wealth, and, in consequence, generally held the highest dignities. A constant feud existed between the two sects. The Sadducees rapidly disappeared after the first century of the Christian era.

Sadi, or **Saadi**, assumed name of the Sheikh Muslik-ed-Din, one of the greatest Persian poets, born at Shiraz about 1184, died there in 1291. In his youth he visited Hindustan, Syria, Palestine, Abyssinia, and made several pilgrimages to Mecca and Medina. While in Syria he was taken by the Crusaders, and compelled to labour as a slave at the fortifications of Tripoli. After about fifty years of wandering he returned to his native city, delighting everybody with his poems and sage precepts. The best of his works are: *Gulistan* (Garden of Roses), a moral work, comprising stories, anecdotes, observations, and reflections in prose and verse; and *Bostān* (The Orchard), a collection of histories, fables, and moral lessons in verse.—Cf. E. G. Browne, *Literary History of Persia.*

Sadiya, a village in the Lakhimpur district of Eastern Bengal and Assam, the north-easternmost frontier station of British India, on the Brahmaputra; served by the Assam-Bengal Railway from Chittagong. Sadiya is a centre of the frontier trade, which is carried on mostly by barter.

Sado, an island of Japan, in the Sea of Japan, off the west coast of Honshu. Gold and silver are mined. Aikawa is the chief town. Area, 337 sq. miles; pop. 112,000.

Sa′dowa, a village on the Bistritz, in Czecho-Slovakia, not far from Königgrätz. It is celebrated as the scene of the preliminary engagement, on 3rd July, 1866, between the Austrians under Benedek and the Prussians under Prince Frederick Charles, which culminated in the decisive battle of Königgrätz, the Prussians being victorious. The whole conflict is also known as the battle of Sadowa.

Safe, a receptacle for valuables, protecting them from fire or burglary. The industry of safe-making owes its origin to the work of Thomas Milner, who took out a patent in 1840 for the use, in the space between the double walls of his safes, of absorbent materials and alkaline solutions or any other liquids which evolve steam or moisture on heating. The fire-proofing of safes to-day follows the lines laid down by Milner, all fire-proof safes being provided with hollow walls filled with salts containing a large proportion of water of crystallization, mixed with an absorbent material. When such a safe is subjected to heat, the water from the crystalline salts is liberated, and its temperature must be raised to a very high value before the ignition temperature necessary to cause the burning of the contents inside the safe can be attained. The remarkable security against the effects of fire of modern safes of first-class make is ample testimony to the efficiency of this simple fire-screen.

To make a safe absolutely burglar-proof is not easy. Every new development in technical science which can be put to use by the burglar has produced new difficulties. The shells of safes are built up of steel plates screwed together in such a way that no screws are visible from the outside. The material used is of such a composition and so heat-treated that it is difficult to drill with even the finest tools. To prevent entry by a crow-bar attack, the door is secured by many bolts on all its edges. These bolts are sent home by the turning of the handle on the safe door. The lock is used to hold the bolt mechanism in place.

Strong-rooms are built of reinforced concrete, the reinforcement consisting often of heavy steel girders. The doors, though large, are constructed like those of ordinary safes. Double-locking arrangements requiring the use of two keys carried by different persons give additional security against theft. The more vulnerable parts to attack of strong-rooms, frequently the floors, are sometimes provided with embedded pipes, any injury of which operates alarm appliances. Electrical appliances to give warning of attempts on strong-rooms and large safes are in common use.

Safed, a city of Palestine, clustered all round the sides of a limestone peak 2750 feet above sea-level, 7½ miles north-west of the Sea of Galilee, which will be served by the Rayak-Al-Arish line via Al-Afuleh. Pop. between 20,000 and 40,000.

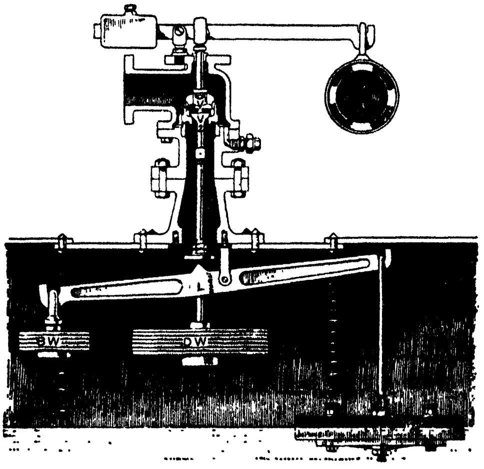
Safed Koh (‘ White Mountains ’), a mountain range of India and Afghanistan. The westerly portion of the chain separates the Herat River valley from the Murghab; the easterly Safed Koh forms the southern boundary of the Kabul basin. These mountains are alpine in their character, and culminate in Sikaram (15,620 feet).

Safety-lamp. The provision of effective illumination for the work of the miner, with security from the possibility of igniting explosive mixtures of coal-gas and air, has been a problem to inventors ever since the introduction of mining. Sir Humphry Davy and George Stephenson both invented safety-lamps burning oil under a wire-gauze shield. Stephenson's lamp, known to miners as the ‘ Geordie ’, has a glass cylinder surrounding the wire gauze, and the air for combustion is passed through a perforated ring below the wick. In all types there are effective locking devices to prevent the opening of the lamps except by the men in charge of the lamp-cabin at the surface. When a miner enters a region in which there is gas present, a characteristic flame within the gauze is noticed, and its presence is taken as a warning of danger by the miner.

Electric safety-lamps provided with a battery and an incandescent lamp of much higher candle-power than the oil-lamps in use have won considerable favour in late years. Though they have greater illuminating value than the old safety-lamps, they do not give any indication of the presence of gas, and a certain number of oil-lamps are still sometimes used by the men whose duty it is to inspect the workings for gas.

Safety-valve, a device for relieving the pressure, usually within a boiler, when it rises higher than is safe or desirable. Lloyd's Register, the Bureau Veritas, the Board of Trade, and the boiler insurance companies all issue rules relating to the pressure at which safety-valves must be set to operate for any given working pressure, and certain of these bodies prescribe dimensions for openings and areas of valves.

The safety-valves are held to their seats by loads applied directly to the valve spindle, by means of weighted levers, or by springs. The downward force on the valve must equal the operating steam pressure multiplied by the area of the valve on which it acts. If the pressure rises to the limiting amount above the working pressure, the safety-valve will be in equilibrium, and any further increase will cause it to rise and allow the steam to pass out into the atmosphere with sufficient noise to attract the attention of the boiler attendant. It is customary to have two safety-valves fitted to each boiler, some authorities insisting on this.



Hopkinson's " Duad " Safety-valve for High Steam and Low Water

V_1, Lever safety-valve of large area to operate for high steam only. V_2, Small area valve loaded by deadweight DW to a pressure slightly in excess of main valve V_1 operated by balanced float F which rises and falls with the water in the boiler, opening and closing V_2 by means of fulcrum point at L. BW, Balance weight. (Reproduced by permission of Messrs. J. Hopkinson & Co., Ltd.)

Boilers are also fitted with other devices calculated to improve their safety of working, such as gauge glasses to indicate the level of the water in the boiler, and high- and low-level indicators to call the attention of the stoker by the blowing of a steam-whistle when the level of water is too high or dangerously low.

Saffi, Safle, or Azfi, an ancient seaport in the French Zone of Morocco, on the west coast between Mazagan and Mogador, at one time an emporium of the European trade with Morocco. The Portuguese held it from 1508 to 1641. Pop. 20,000, 3000 being Jews and about 700 Europeans.

Safflower, or Bastard Saffron (*Carthămus tinctorius*), a large thistle-like plant with orange-coloured flowers, nat. ord. Compositæ. It is cultivated in China, India, Egypt, and in the south of Europe. An oil expressed from the seeds is used as a lamp-oil. The dried flowers yield the dye carthamin (q.v.). Safflower is used to adulterate saffron, and, mixed with finely powdered talc, it forms a common variety of rouge.

Saffron (*Crocus sativus*, nat. ord. Iridaceæ), a low ornamental plant with grass-like leaves and large crocus-like purple flowers, cultivated in the East and in Southern Europe for the sake of its stigmas. These when dried form the saffron of the shops, which has a deep-orange colour, a warm bitterish taste, and a sweetish penetrating odour. Its orange-red extract is used by painters and dyers, and the saffron itself also in cookery and confectionery as a colouring and flavouring substance. See *Safflower*; *Colchicum*.

Saffron-Walden, a municipal borough of England, in the county of Essex; served by the Great Eastern Railway. It carries on trade in grain and cattle, and has industries in brewing and malting. It dates from a period anterior to Edward the Confessor. Pop. (1921), 5880.

Saga, an old Norse word meaning narrative, is more particularly the name of a branch of literature developed in Iceland, a kind of prose epic or historical novel. Icelandic literature may be divided into three classes, the poetry of the Edda, the poems of the skalds, and the prose sagas. It is the last named which have given Iceland a claim to have contributed to the masterpieces of the world's literatures.

The isolation of the scattered homesteads of the original settlers in Iceland made them keenly interested in any news from the outer world and in stories of the past. Story-telling was a popular pastime with them in winter, and saga-man became a recognized profession. It is a remarkable fact that the saga was not cultivated in Norway in spite of the similarity of conditions there.

The great literary sagas were written in the eleventh and twelfth centuries. The finest of them are historical or biographical. They are divided into two classes, the 'sagas of Icelanders' (*Islendingasögur*) and the 'sagas of kings' (*Konungasögur*); the former deal with the lives of notable Icelanders and the latter with the lives of Norwegian kings. The remarkable feature of the saga is its complete objectivity. The author and his personal views are entirely in the background. The characters are developed through their words and actions. Dialogue is used with dramatic vigour and effect. Each of the *Icelanders' sagas* centres round the life of some famous Icelander, his travels and adventures, his loves, and particularly his hatreds and their consequences. Some account of his ancestors and descendants is also given, the latter often in connection with the avenging of his death. The fondness for genealogical details is, with an enthusiasm for discussions on abstruse points of law, an aspect of the sagas which the modern reader will not appreciate so much as the circles for which they were originally written. The sagas give a picture of the political and social life of the times such as we possess for no other country of mediæval Europe. Among the better known are the *Egils-saga*, the history of the skald Egil and his family, unrivalled in the simplicity and nobility of its language; and the *Njals-saga*, perhaps the saga best known to the outside world, a story of woman's hate, containing two of the finest characters in the sagas, Njal and Gunnar. Of the historical sagas of kings, the great collection is the *Heimskringla* ('circle of the world') made by Snorri Sturluson (q.v.). The *Volsunga-saga* is mythical rather than historical, and is important as containing an earlier version of the story of Siegfried than that given in the *Nibelungenlied*.—BIBLIOGRAPHY: Eugen Mogk, *Norwegisch-Isländische Literatur*; W. A. Craigie, *Icelandic Sagas*. The following are some English translations: Sir G. W. Dasent, *Njals-saga*; M. A. C. Press, *Laxdaela-saga*; E. Magnusson, *Grettis-saga*; W. G. Green, *Egils-saga*; W. Morris and E. Magnusson, *Saga Library* (includes *Heimskringla*).

Sagaing, a division, district, and town of Upper Burmah. *Division.*—The division comprises the four districts of Sagaing, Shwebo, and Upper and Lower Chindwin. Lower Chindwin, Sagaing, and Shwebo are included in the Upper Burmah dry division, i.e. they form part of the arid zone which extends across the valley of the Irawadi from the 20th to the 23rd parallel of latitude, and consist mainly of an open plain relieved sporadically by masses of hills. Area, 29,566 sq. miles; pop. about 1,108,000. *District.*—The district lies on both sides of the Irawadi. It is traversed by the Sagaing-Myitkyina Railway, which is connected by Trans-Irawadi steam-ferry with the Rangoon-Mandalay system at Amarapura; these two lines form the backbone of the Burmese railway system. Rice, native food grains, onions, tobacco, chillies, sweet potatoes, indigo, some wheat, sesamum, millet, peas, and cotton are produced. Area, 1862 sq. miles; pop. about 284,000. *Town.*—The town is the head-quarters of both the division and the district, and stands on the Irawadi, opposite Amarapura. Pop. 10,000.

Sagan, a town of Prussian Silesia, on the Bober. Cloth is made. There are paper-, wood-pulp-, and woollen-mills. The principality of Sagan was formed in 1397, and existed with an area of 500 sq. miles until the European War. Pop. 15,000.

Sagape′num, a gum resin obtained from a species of Ferŭla which grows in Arabia and Persia. It is somewhat similar to asafetida and galbanum, and has been used in place of these in hysteria.

Sage, the common name of plants of the genus Salvia, a very large genus of gamopetalous dicotyledons, nat. ord. Labiatæ, containing about 450 species, widely dispersed through the temperate and warmer regions of the globe. They are herbs or shrubs of widely varying habit, usually with entire or cut leaves and various-coloured (rarely yellow) flowers. The best known is the *S. officinālis*, or garden sage. This plant is much used in cookery.

Saginaw (sag-i-nạ′), a city of Michigan, United States, the county seat of Saginaw county, on the Saginaw River, about 17 miles from Lake Huron. There are railway repair-shops, and the city is a distributing wholesale centre for food-stuffs and domestic requirements. Pop. (1920), 61,903.

Sagitta (sa-jit′a), the type-genus of worms embraced in the small phylum Chætognatha. They are small, transparent, marine animals, about an inch long, and are found all over the world.

Sagitta′rius (the Archer), in astronomy, the ninth sign of the zodiac, into which the sun enters 22nd Nov. The constellation Sagittarius now nearly coincides with the sign Capricornus, and is the most southerly constellation of the zodiac. It contains a particularly dense and brilliant portion of the Milky Way.

Sago, a starchy product obtained from the pith of several species of a genus of palms named Sagus (or Metroxylon), more especially *S. Rumphii* and *S. lævis*. The latter, from which the finest sago is prepared, forms large forests in Borneo, Celebes, Sumatra, and other islands and countries adjacent, each stem yielding from 100 to 800 lb. of sago. The tree is about 30 feet high, and from 18 to 22 inches in diameter. It is cut down at maturity, the medullary part being extracted and reduced to powder like sawdust.

The woody fibres are separated by washing and straining, and the deposited starch is dried and forms *sago flour. Pearl sago* is made from the flour by granulating it with sieves and drying or roasting after it has been mixed with water to form a paste. Much sago is exported to Europe from Singapore.

Sa′goin, or **Sagouin**, the native name of a genus (Callithrix) of Central and South American monkeys. They are active and graceful little animals.

Sagua la Grande, a city of Cuba, in the province of Santa Clara, on the River Sagua la Grande. The port is La Isabela. There are machine-shops and lumbering industries. Pop. 12,000.

Saguenay (sag′e-nā), a river of Canada, in the province of Quebec, formed by two outlets of Lake St. John, and joining the St. Lawrence at Tadoussac Harbour; length, 120 miles. For many miles of the latter part of its course it runs through barren gorges, walled in by cliffs more than 1000 feet high, and in places it attains a depth of 800 feet. The Saguenay is navigable for vessels of any size to Ha Ha Bay, a distance of over 50 miles from the St. Lawrence, and at high water for 15 miles farther.

Sagunto, or **Murviedro** (ancient **Saguntum**), a city of Spain, in the province of Valencia. It is famous in Roman history, and its siege by Hannibal (219–218 B.C.) gave rise to the second Punic War. Pop. 9000.

Sahara (sa-hā′ra; properly sä′h*a*-rä), **The**, a vast, sandy tract of Northern Africa lying north and south of the Tropic of Cancer, between the Atlantic and the Nile. In the north it extends to and forms part of Algeria, Tunisia, Tripoli (Libya), Egypt, and the Anglo-Egyptian Sudan; in the south it is chiefly bounded by the Sudan. This immense area, calculated at over 3½ million sq. miles, is not a great level ‘ desert ’, in the popular sense of the term; on the contrary, it offers considerable variety of configuration and vegetation. It consists of a central highlands, the Tazili or Plateau of Ajer, with the Ahaggar massif, on the west; the Tibesti Mountains, farther east, culminating in Mount Tusidde (7800 feet altitude); and Emi Koussi (11,000 feet). On the west and east of this elevated tract there are the basins of great quaternary river systems, now occupied respectively by the basins of the Western Sahara and the Libyan Desert. On the north lie the Great Erg of the Sahara, Tripoli (Libya), and the Fezzan. On the south the Sahara passes into grass-lands where the rivers turn back, as in the case of the Niger, or come to a standstill, as in the case of the affluents of Lake Tchad, and pass into the watered country of the Sudan. The Central Desert or desert proper lies away from the sea, and consists of regions of shifting sand-dunes (the Ergs), of stony desert (the ‘ Hammada ’), or of pebbly, gravelly desert (the Serir). In the centre of the Sahara there is a wide plateau of sandstone which extends from the Tazili or Plateau of Ajer to the Ennedi Hills, south of the Tibesti highlands. The Ennedi are granite hills capped with volcanic cones, rising to 11,000 feet. This great line of high ground is generally held to be continuous with the Marah Hills in Darfur, and also with the Congo-Nile watershed farther south. In the Tibesti highlands there are running streams, and the valleys are wooded. The vegetable wealth of the desert-dweller lies in the date-palm. Among the desert population, estimated at 2½ millions, the Berbers predominate; they are divided into the Tuaregs and the Tibus of Tibesti. Climatic conditions are of the severe continental variety. Noon temperatures of between 105° and 112° F. are followed by midnight temperatures of several degrees of frost, and at dawn there may be a heavy shower. Rainless thunderstorms are common, and in the desert proper rain only falls sporadically, and then over limited areas. The oases are areas of the desert occupying dried-up watercourses, where the water, which still flows underground, reaches the surface as springs, or is obtained by boring. Tafilet south of the Anti-Atlas, Twat on the opposite side of the Erg, and Gurara between them are important oases.—BIBLIOGRAPHY: H. J. Llewellyn-Beadnell, *Sand Dunes of the Libyan Desert* (in *Geographical Journal*, April, 1910); E. Suess, *The Face of the Earth* (English translation by Hertha Sollas, vols. i and iv).

Saharanpur, a district and city in the Meerut division of the United Provinces, India. The district forms the northern part of the Doab (alluvial plain) between the Ganges and the Jumna, and is served by the North-Western and the Oudh & Rohilkhand Railways. Wheat, rice, barley, and maize are the chief crops; cotton and sugar-cane are also raised. Area, 2228 sq. miles; pop. 1,100,000. The city is the district headquarters. Pop. 70,000 (one-half Mahommedan).

Saiga (sī′ga; *Antilŏpe Saiga*), a species of antelope found on the Russian steppes, about 2½ feet in height, with spiral horns, tawny coloured in summer, light-grey in winter. The saiga and the chamois are the only European antelopes.

Saigon (sī-gon′), capital of French Cochin-China, of which it is the chief trading emporium, on the Saigon River, 35 miles from its mouth in the South China Sea, one of the finest cities in the East.[1] The bulk of the native business is carried on in the suburb of Cholon. The Saigon River is navigable, even at ebb-tides, by the largest vessels up to the town, and an active trade with China, Siam, Singapore, Java, &c., is carried on, rice being the staple article of export. Pop. (1921), 72,800 (4000 Europeans. Pop. (Cholon), 226,600 (100,000 Chinese).

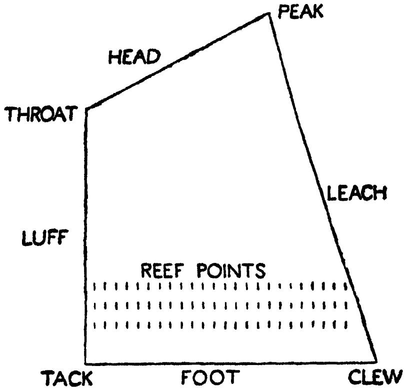
---

[1] The territory tributary to Saigon includes Cochin-China, Cambodia, Southern Laos, and Annam south of Cape Varella.

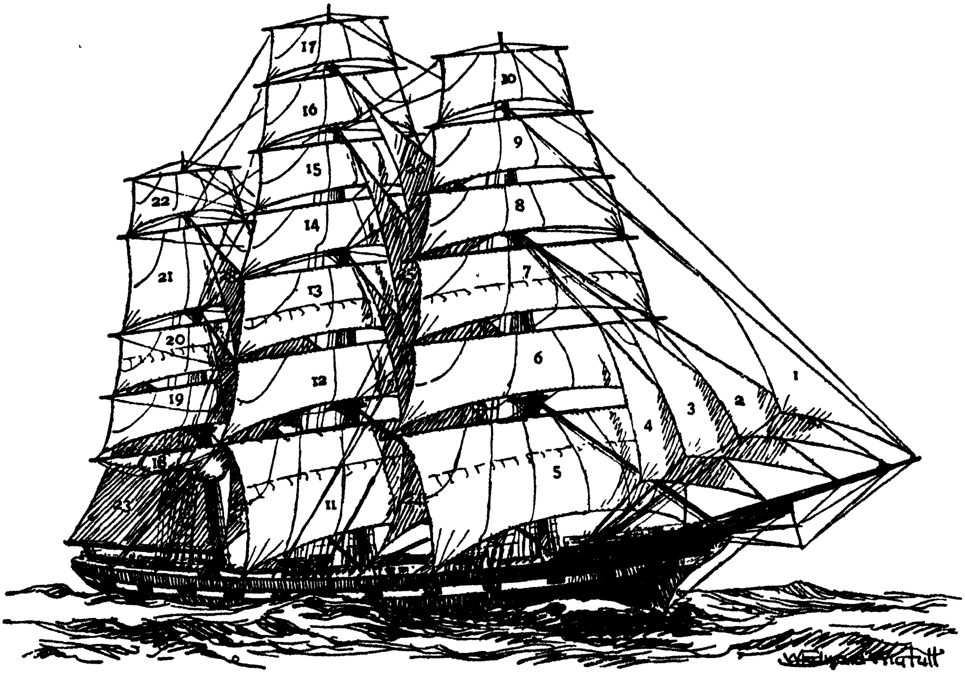
Sail, a piece of canvas or tissue of some kind spread to the wind to impel or assist in impelling a vessel through the water. Sails are usually made of several breadths of canvas, sewed together with a double seam at the borders, and edged all round with a cord or cords called the *bolt-rope* or *bolt-ropes*. Boat sails are generally made of duck. A sail extended by a yard hung by the middle is called a *square sail*; a sail set upon a gaff, boom, or stay, so as always to hang more or less in the direction of the vessel's length, is called a *fore-and-aft sail* (see diagram). Sails generally take their names from the mast, yard, or stay upon which they are stretched; thus, the main-course (main-sail), main-top sail, main-topgallant sail, are respectively the sails on the main-mast, main-topmast, and main-topgallant mast.

The type of vessel below (three masts and square rigged on all masts) is technically known as a *ship*.

Four-masted ships are not uncommon. The distinctions are as follows: (1) *barque*, three masted, square-rigged fore and main but fore-and-aft rigged mizzen; (2) *barquentine*, three masted, square-rigged foremast, fore-and-aft rigged main and mizzen; (3) *brig*, two masted, both square-rigged but with boom main-sail; (4) *schooner*, two masts, fore-and-aft rigged on both (generally); a *topsail schooner* carries a square topsail on the foremast; (5) *cutter*, one mast, fore-and-aft rigged; a *yawl* is similar, carrying a mizzen mast stepped aft, and a *ketch* is similar to a yawl, but the mizzen mast is well before the rudder head.



Part of a Fore-and-aft Sail



Sails of a Ship-rigged Vessel

1, Flying jib. 2, Outer jib. 3, Inner jib. 4, Fore-topmast staysail. 5, Fore-sail or fore-course. 6, Lower fore-topsail. 7, Upper fore-topsail. 8, Lower fore-topgallant sail. 9, Upper fore-topgallant sail. 10, Fore-royal. 11, Main-sail or main-course. 12, Lower main-top sail. 13, Upper main-top sail. 14, Lower main-topgallant sail. 15, Upper main-topgallant sail. 16, Main-royal. 17, Main-skysail. 18, Cross-jack (brailed up). 19, Lower mizzen-topsail. 20, Upper mizzen-topsail. 21, Mizzen-topgallant sail. 22, Mizzen-royal. 23, Spanker or driver. 24, Main-topmast staysail. 25, Main-topgallant staysail. 26, Main-royal staysail. 27, Mizzen-topmast staysail. 28, Mizzen-topgallant staysail.

Sainfoin, a plant, *Onobrȳchis sativa*, nat. ord. Leguminosæ, a native of Central and Southern Europe and part of Asia, long cultivated as a fodder plant, and used either green or converted into hay. It is a pretty plant with narrow pinnate leaves and long spikes of bright-pink flowers; stem 1½ to 2 feet high. It is a hardy perennial, and will produce crops where clover and rye-grass are grown with difficulty.

Saint Albans, a municipal borough and cathedral city of Hertfordshire, England. It is noted for its fine cathedral or abbey church, originally founded (793) by Offa, King of Mercia. The Church of St. Michael was founded about the middle of the tenth century; it contains the tomb of Francis Bacon. During the Wars of the Roses two battles were fought at St. Albans; the first in 1455 when Henry VI was defeated and taken prisoner by the Yorkists under Richard, and the second in 1461 when the Yorkists were routed. St. Albans was incorporated by Edward VI in 1554 and sent two members to Parliament until 1852. On the introduction of printing to England, the third press was set up in the Abbey by Abbot Wallingford (1480). Straw-plaiting, silk-weaving, printing, brewing, and other industries are carried on. Pop. (1921), 25,590.

St. Albans, a city of Vermont, United States, the county seat of Franklin county, bordering on Lake Champlain. It is a great dairying centre; the quotations of butter and cheese at St. Albans affect the market throughout the eastern states. Manufactures include agricultural implements and iron and steel products. Pop. 7000.

Saint-Amand-les-Eaux (saṇ-tȧ-mȧn-lā-zō), a town of France, in the department of Nord, on the Scarpe. It is famous for its hot sulphurous springs, and has manufactures of fine cotton yarns, &c. Pop. 14,300.

St. Andrews. See *Andrews, St.*

St. Anne's-on-Sea, an English watering-place in Lancashire, on the Ribble estuary, opposite Southport; served by the London & North-Western and the Lancashire & Yorkshire (Joint) Railways. It has a promenade, public gardens, golf-links, &c. Pop. 10,000.

St. Asaph. See *Asaph, St.*

St. Augustine, a maritime city and port of entry of Florida, United States, the county seat of St. John's county. The city is best known as a winter-resort on account of the exceptional equability of the climate. The mean annual temperature is 70° F.; mean winter temperature about 58° F. It is said to be the oldest town in the United States, having been founded by the Spaniards under Menendez on St. Augustine's Day (28th of Aug.), 1565. Pop. 5600.

St. Austell, an urban district and town of England, in the county of Cornwall; served by the Great Western Railway. It has a large trade in kaolin or china-clay, produced from beneath the worn-out lodes of tin and copper of the famous Carclaze mines. Pop. (1921), 3250.

St. Bees, a town of Cumberland, England; served by the Furness Railway. It has a grammar-school founded by Archbishop Grindal in 1587, and enlarged in 1881. Pop. 1400.

St. Catharine's, a city and port of entry of Ontario, Canada, on the Welland Canal, near Lake Ontario. It has mineral-springs, is a centre of fruit-growing and canning, has flour- and saw-mills, and carpet works. Pop. 18,000.

Saint Catharine's College, Cambridge, was founded in 1473 by Robert Wodelarke, chancellor of the university and provost of King's College.

St. Cyr (sēr), a village of France, in the department of Seine-et-Oise, 14 miles west of Versailles; famous for the seminary for the education of ladies of rank which Louis XIV founded here. Since 1803 the buildings have been used as a military academy. Pop. 5000.

Sainte-Beuve (saṇt-b*eu*v), Charles Augustin, French critic, born 1804, died 1869. His contributions to the *Revue des Deux Mondes* on French authors and literature formed for a considerable period the chief attraction of that periodical. In 1840 he was appointed conservator of the Mazarin Library, and in 1845 admitted a member of the French Academy. After 1848 he contributed a number of critiques to the Monday numbers of the *Constitutionnel* and then to those of the *Moniteur* (*Causeries du Lundi*, *Nouveaux Lundis*). Most of his critical writings have been republished in various editions. He also wrote three volumes of poetry (1829–37), under the *nom de plume* 'Joseph Delorme'; but these do not rank high, although his ideal of poetry was of the very highest.—Cf. G. M. Harper, *Sainte-Beuve*.

Sainte Croix (saṇt krwä), or **Santa Cruz**, a West Indian island, one of the Virgin group, sold by Denmark to the United States in 1916–7. It lies 40 miles S.S.E. of St. Thomas, and has an area of 74 sq. miles. There are two towns, Christiansted (pop. 4580) and Frederiksted (3150). The chief industries are agricultural. See *Virgin Islands.*

St. Elias, Mount, a snow-capped volcanic mountain situated in the north-west of Canada, near the boundary with Alaska, about 25 miles from the Pacific. It rises 18,020 feet above sea-level, and was scaled by H.R.H. the Duke of the Abruzzi in 1897.

St. Eloi, a village of Belgium, in the province of West Flanders, about 3 miles south of Ypres, at the junction of the two main roads, the Ypres-Armentières road, north and south, and the Ypres-Warneton road, which branches off in a south-easterly direction. St. Eloi was the scene of much local fighting during the European War, the main engagements taking place in March, 1915, and March, 1916.

Saintes (saṇt), a town of France, in the department of Charente-Inférieure, on the Charente. It has an old cathedral and interesting Roman remains, including a triumphal arch erected in the time of Nero, and the ruins of an amphitheatre. Manufactures include iron and copper, and the trade is in brandy, wool, and corn. Pop. 20,000.

Saint Étienne. See *Étienne, St.*

Saint Eustatius. See *Eustatius.*

Saint-Evremond (saṇt-āvr-mōṇ), Charles Marguetel de Saint-Denis, Seigneur de, French author, born in 1613, died 1703. He was a staunch royalist, but, compromised by the disgrace of Fouquet, and afraid of Mazarin, he fled to England in 1661, and was welcomed and pensioned by Charles II. His satirical writings and his letters are of some interest. One of the former is his *La Comédie des Académistes.*

St. Francis, a river of the United States, forming part of the boundary between Arkansas and Missouri, and entering the Mississippi near Helena. At high water it is navigable for about 150 miles; total length, 450 miles.

Saint Gall. See *Gall, St.*

Saint Germain. See *Germain, St.*

St. Helena, a British island of the South Atlantic, 696 miles south-east of Ascension, and about 1200 miles from the nearest point of the African coast. Area, 47 sq. miles; pop. (1921), 3747. *Physiography.*—It is entirely volcanic, consisting largely of basalts, and stands near the mid-oceanic rise which divides the Atlantic in two. Most of the island stands over 1500 feet in altitude; the south-easterly crater, which is 3 miles in diameter, attains 2697 feet altitude in Diana's Peak. St. Helena lies full in the track of the south-east trade-winds, and the climate is therefore oceanic, averaging between 65° and 75° F. on the uplands, and up to 85° F. in the sheltered anchorage at Jamestown. The annual upland rainfall is 40 inches. A few of the indigenous trees remain, but European domestic animals have entirely supplanted the original fauna. Cattle are raised, and some are exported to Ascension. *Communications.*—St. Helena is an Admiralty coaling-station, and about two of the Cape of Good Hope squadron pay an annual visit. The Eastern Telegraph Company's cable lands on the island and connects it with St. Vincent and Cape Town. About forty vessels call annually, and nearly all are British. *People.*—The people are of mixed European, African, and East Indian race, and are descended in part from emancipated slaves. Jamestown, built in a ravine with almost vertical sides, is the port and capital.

History.—St. Helena was discovered by João de Nova in 1501. It was settled by some Portuguese who had been expelled from the East Indies. In 1645 the Dutch established a post which they relinquished to the English, and in 1668 it was taken over by the East India Company, reverting later to the Dutch, and being recaptured by Captain Munden in 1673, since when the island has remained British. From 1815 to 1821 St. Helena was the island-prison of the Emperor Napoleon, and in 1822 the East India Company resumed control, and the island continued to prosper until the opening of the Suez Canal. A Governor administers the island, and a detachment of Royal Marine Artillery is in garrison.

St. Helens, a county borough of Lancashire, England. It owes its rise to the extensive coal-beds in the vicinity, its proximity to Liverpool and the facility of communication, and to the introduction of various branches of manufacture, more especially that of glass. There are also important copper-, iron-, lead-, and chemical-works, manufactures of patent medicines, and potteries. Pop. (1921), 102,680.

St. Helens, an urban district of England, in the Isle of Wight, 4 miles south-east of Ryde; served by the Isle of Wight Railway. Pop. 6000.

St. Helier, the seaport-capital of the island of Jersey, on the south coast, on the east side of St. Aubin's Bay. The chief public building is the House of Assembly (Salle des États). There is a considerable shipping trade. The mild climate makes it a favourite place of residence and summer-resort. It is the seat of the States, or representative Parliament of Jersey, and has industries in shipbuilding, brewing, and fishing. Pop. 30,000.

St. Hyacinthe, a city of Canada, in the province of Quebec, on the Yamaska and Black Rivers. It has manufactures of gloves, biscuits, boots and shoes, and agricultural machinery. Pop. 9800.

St. Ives, a municipal borough and seaport town of Cornwall, England, on St. Ives Bay. The principal business of the place is the pilchard fishery, with some boat-building and rope-making. The original town stood on a promontory eastward of the present town, and is supposed to have been overwhelmed by sand-drifts. Pop. (1921), 6950.

St. Ives, a municipal borough of Huntingdonshire, England, on the Ouse. It is an agricultural centre, and has important cattle markets. Pop. (1921), 2800.

St. John, a city and port of Canada, in the province of New Brunswick, capital of St. John county, at the mouth of the River St. John in the Bay of Fundy. It is built on a rocky and irregular peninsula projecting into the harbour. The city is the only one in Canada having the ownership of its own harbour. The port is open all the year round and at all tides, the high-water depth being from 58 to 60 feet, and the low-water depth at the entrance channel 32 feet. It is the winter port of Canada between 1st Nov. and 1st May. Pop. 63,000.

Saint John, a river partly belonging to the United States, partly to Canada, the last 230 miles of its course being in New Brunswick; total length, 550 miles. It is navigable for large steamers to Fredericton, a distance of 80 miles. About 225 miles up are the Grand Falls, 75 feet high. The city of St. John is at its mouth.

Saint John's, the capital and the largest town of Newfoundland, on Avalon Peninsula in the south-east of the island, and the centre of the insular railway system. It has a harbour and dry dock, is served regularly by transatlantic steamships, and is protected by several strong batteries and forts. A great part of it consists of wooden houses. St. John's commands almost the entire trade of the island, and is the centre of the fisheries. Cod and seal oils are produced and exported on a large scale. Other important export articles are cured fish, seal-skins, and copper ores. Pop. 34,100.

St. John's, a town of Canada, in the province of Quebec, 18 miles south-east of Montreal. Lumber and agricultural produce are traded; bricks and furniture are made. Pop. 6000.

St. John's College, Cambridge, a college founded in its present form by Margaret, Countess of Richmond and Derby, mother of King Henry VII, in 1511. The chapel (1869) is by Sir Gilbert Scott, and is a fine specimen of the early decorated style. Ascham, Bentley, Herrick, Prior, Rowland Hill, Wilberforce, Wordsworth, and Lord Palmerston were members of the college. It has a library containing over 40,000 volumes and about 1000 manuscripts.

St. John's College, Oxford, a college founded in 1555 by Sir Thomas White, knight, and alderman of London. Archbishop Laud built the inner quadrangle, after a design by Inigo Jones, and made valuable contributions to the library.

St. John's Wort (Hypericum), a genus of plants, ord. Hypericaceæ. The species are mostly small showy shrubs. The flowers are five-petalled, and usually yellow. The leaves and blossoms, when rubbed between the fingers, emit a strong resinous odour and have a bitter taste, due to a volatile oil which has astringent and tonic properties. *H. perforātum*, to which at one time the name of St. John's wort was limited, has its leaves marked with pellucid dots, giving them a perforated appearance. *H. calycīnum* or Aaron's-beard, is a shrubby plant with handsome flowers. Its leaves are also dotted.

St. Joseph, a city and port of entry of Missouri, United States, the county seat of Buchanan county, on the Missouri. St. Joseph owes its great commercial importance to its development of a comprehensive transport system. There are great stockyards in South St. Joseph, a manufacturing suburb to which are attached meat canneries. St. Joseph proper is the centre of an immense dry-goods trade. It was founded in 1846, and became a city in 1857. Pop. (1920), 77,940.

Saint-Just (saṇ-zhüst), Antoine Louis Léon Florelle de, French revolutionary, born 1767, executed 1794. Energetic and resolute, he became the right hand of Robespierre. He was an effective speaker, but unscrupulous and uncompromising. The guillotine was his general answer to all arguments and actions which did not harmonize with his own. He fell with Robespierre owing to the events of the 9th Thermidor (27th July, 1794; see *France, History*), and perished on the same scaffold with him on the following day.

St. Kilda. See *Kilda, St.*

St. Kitts and Nevis, a presidency of the Leeward Islands, British West Indies. It comprises the Islands of St. Christopher, Nevis and Anguilla, with their dependencies. Nevis was discovered by Columbus (1498), and received an English colony from St. Kitts (1628). Charlestown (pop. 1150) is the capital. Area, 50 sq. miles. The total population of the presidency is (1921) 38,214; area, 150 sq. miles.

St. Lawrence, one of the largest rivers in the world, which drains the great chain of North American lakes. In different parts of its course it is known by different names. From the sea to the foot of Lake Ontario it is called *St. Lawrence*; between Lakes Ontario and Erie it is called *Niagara* River; between Lakes Erie and St. Clair, *Detroit* River; between Lakes St. Clair and Huron, *St. Clair's* River; between Lakes Huron and Superior, *St. Mary's* River or the *Narrows*; and from the head of Lake Superior to its source near that of the Mississippi, the *St. Louis* River, forming thus an uninterrupted waterway of upwards of 2100 miles. It receives the Ottawa, its principal auxiliary, at Montreal, as also the St. Maurice, the Saguenay, and numerous other large rivers from the north. The river is navigable for Atlantic steamers to the city of Montreal, 600 miles up, and from Montreal upwards by river and lake steamers. The rapids between Montreal and Lake Ontario are passed by means of canals, and Niagara Falls by the Welland Canal. The river's breadth between Montreal and Quebec is from ½ mile to 4 miles; the average breadth, about 2 miles. Below Quebec it gradually widens till it enters the Gulf of St. Lawrence. From the beginning of December to the middle of April navigation is suspended by ice. The principal towns of Canada are situated in the St. Lawrence area.

St. Lawrence, Gulf of, a drowned valley which is a large inlet of the North Atlantic in Canada, forming the continuation of the estuary of the River St. Lawrence, and separated from the *Atlantic* chiefly by the Island of Newfoundland, Cape Breton, and Nova Scotia. It communicates with the ocean by the opening betwixt Newfoundland and Cape Breton, about 65 miles wide, by the Strait of Belle-Isle, and the Gut of Canso. It contains numerous islands, the principal of which are Anticosti, Prince Edward, and the Magdalens.

St. Louis (saŋ-lō′i), a municipal commune and seaport of French West Africa, the capital of the colony of Senegal, on the Island of Sor, at the mouth of the Senegal River. Pop. 23,830 (about 300 being French).

St. Louis, a city and port of entry of Missouri, United States, on the Mississippi. The importance of St. Louis is due primarily to its commanding position in the south-central Mississippi Valley, which it has developed by means of efficient transport by rail and river. The latter was at first the most important, but has now entirely given place to the railroads, although the city is still a port of entry for foreign commerce. Meat packing and slaughtering are important, but are more highly developed in East St. Louis. St. Louis is the largest tobacco-manufacturing city of the United States, and leads in the production of railway rolling-stock, street cars, white lead, and wooden goods. There are also chemical-, paint-, and hardware-works and flour-mills, as well as cloth-mills and coffee-manufacturing establishments. Pop. 773,000.

St. Louis, East, a city of Illinois, United States, the county seat of St. Clair county, on the Mississippi opposite St. Louis; served by sixteen railway systems, which cross the river to St. Louis by a steel arch bridge. There are large industries in slaughtering and meat packing, and to a lesser extent in iron-founding and flour-milling. Pop. 66,740.

St. Lucia, an island of the British West Indies, the most northern and largest of the Windward group, about midway between Martinique (north) and St. Vincent (south). Area, 233 sq. miles; pop. (1921), 51,500. The mean annual temperature is about 78° F., with a mean maximum of 80° and a minimum of 71°. The climate is healthy. The annual rainfall is about 79 inches at Castries, the capital, a coaling-station and naval base. Among products are sugar, molasses and syrup, rum, cocoa, lime-juice, lime-oil, bay-oil, honey, hides, logwood, and fuel. St. Lucia is administered by an Administrator and Secretary, who are assisted by a nominated Executive and Legislative Council. For certain purposes the four islands of Grenada, St. Vincent, the Grenadines, and St. Lucia are united as the Windward Islands, but otherwise each island has its own institutions and is entirely self-governing.

St. Malo, a watering-place and port of North-Western France, in the department of Ille-et-Vilaine, on a granite island at the mouth of the Rance, connected with the mainland by the Sillon, a causeway about 650 feet long. Pop. 11,000.

St. Martin. See *Martin, St.*

St. Mary's River, the outlet of Lake Superior into Lake Huron, about 60 miles long. At Sault Ste Marie, or St. Mary's Falls, near Lake Superior, navigation is obstructed by rapids, and canals are used to facilitate traffic.

St. Maurice, a river of Canada, in the province of Quebec, entering the St. Lawrence at Three Rivers after a course of about 300 miles. It is navigable between Grand Piles and La Tuque, and is used for floating lumber.

St. Michael's Mount, a conical rock on the south-west coast of England, in the county of Cornwall, on the north-west side of Mount's Bay, height 250 feet, connected with the mainland by a natural causeway, which is dry at low water. On its summit are the remains of a monastery founded by Edward the Confessor.

Saint-Michel (saŋ-mi-shel), **Mont**, a fortified rocky height in the department of La Manche, France, in Cancale Bay, 7 miles south-west of Avranches. On its summit are a castle and an interesting church of the tenth century. There is a straggling village on the hill, with a population of about 300. It can be approached across the sands at low water.

St. Mihiel, a town of France, in the department of the Meuse. It has lace manufactures. During the European War the Germans took the town (25th Sept., 1914), and it was not retaken until Pershing's American troops flattened out the St. Mihiel salient in Sept., 1918. See *European War.*

Saint Nazaire, a town and port of France, in the department of Loire-Inférieure, at the mouth of the Loire, about 32 miles from Nantes, of which it is the out-port. The construction of new docks and the renovation of the old basin and quayage have transformed it into an important shipping centre. Cereals, tobacco, salt, brandy, and coffee are traded. Pop. 38,000.

St. Neots, an urban district of Huntingdonshire, England, on the Ouse; served by the Great Northern Railway. Pop. (1921), 4110.

St.-Nicolas, a town of Belgium, in the province of East Flanders. The manufactures are important, especially in cottons, woollens, and linens. Its fairs are much frequented. Pop. 35,000.

St. Omer, a town and port in France, in the department of Pas-de-Calais, in a marshy district on the Aa and on a canal. It ranks as a fortress of the second class, and it has a fine church (Notre Dame). The abbey church of St. Bertin at St. Omer was at one time the noblest Gothic monument of French Flanders. It manufactures woollen cloth, thread, and starch, and has an important trade. The British head-quarters during the European War were at St. Omer from Oct., 1914, to March, 1916. Pop. 80,000.

Saintonge, one of the pre-Revolutionary provinces of France, bounded by the Atlantic, Poitou, Guienne, and Angoumois. It belonged to the English from the time of Henry II until it was conquered by Charles V. It is chiefly comprised in the departments of Charente and Charente-Inférieure.

St. Ouen, a town and river-port of France, in the department of Seine, on the Seine. There are manufactures of pianos, soap, chemical products, and machinery, and there is also a racecourse. Pop. (1921), 50,900.

St. Pancras, a metropolitan borough of London, England, which extends northward to form a part of the county boundary. It embraces among others the central districts of Kentish Town and Camden Town, and those of Chalk Farm and Somerstown. St. Pancras contains terminal stations and vast goods depôts of several important railway systems, viz. King's Cross (Great Northern Railway), St. Pancras (Midland Railway), and Euston (London & North-Western Railway). University College is located in Gower Street, and there are several of the principal London hospitals (such as the Royal Free Hospital) within the borough. See *London*. Pop. (1921), 210,986.

St. Paul, a city and port of entry of Minnesota, United States, the state capital and the county seat of Ramsey county, at the head of navigation on the Mississippi, 2150 miles from its mouth. St. Paul is the port of entry for the Minneapolis customs district, and is served by several lines of river steamers, while imports from Canada and the East are important. St. Paul is second only to Minneapolis as the chief manufacturing centre of Minnesota, fur goods, printing and publishing, and tobaccos being important. South St. Paul, a contiguous city, has large stockyards and slaughtering and canning industries. Dairy products, farm produce, and coal are exported. Pop. (1921), 234,700.

St. Paul's Cathedral, London, is situated on Ludgate Hill, an elevation on the north bank of the Thames. The site of the present building was originally occupied by a church erected by Ethelbert, King of Kent, in 610. This was destroyed by fire in 1087, and another edifice, Old St. Paul's, was shortly afterwards commenced. The structure was in the Gothic style, in the form of a Latin cross, 690 feet long, 130 feet broad, with a lead-covered wooden spire rising to the height of 520 feet. The middle aisle was termed Paul's Walk, from its being frequented by idlers as well as money-lenders and general dealers. Old St. Paul's was much damaged by a fire in 1137, by lightning in 1444, again by fire in 1561, and was utterly destroyed by the Great Fire in 1666. The ruins remained for about eight years, when the rebuilding was taken in hand by the Government of Charles II (1675–1710). The whole building was completed under one architect (Sir Christopher Wren), and one Bishop of London (Dr. Henry Compton). The building is of Portland stone, in the form of a cross. Its length is 510 feet; the width from north to south portico, 282 feet; the general height is 100 feet. The whole is surmounted by a great dome (q.v.) raised on eight arches. Above the dome is a lantern or gallery terminated above by a ball and gilded cross, 404 feet from the pavement beneath. The pavement of the interior is composed of slabs of black and white marble. The crypt under the nave is the burying-place of many famous men. Among the numerous monuments and statues may be mentioned those of John Howard and Dr. Johnson, by Bacon; statues of Nelson, Earl Howe, and Sir Joshua Reynolds, by Flaxman; Bishop Heber, by Chantrey; and monuments to Lord Rodney, Lord Heathfield, Admiral Collingwood, General Abercrombie, &c., by Rossi, Westmacott, and others. The monument to the Duke of Wellington, by Alfred Stevens, is accounted the finest work of its kind in England. It consists of a rich marble sarcophagus and canopy elaborately ornamented with bronze sculptures. A scheme of reconstruction and renovation of the cathedral, inaugurated in 1914, was in progress in 1922.—BIBLIOGRAPHY: Rev. Canon Benham, *Old St. Paul's*; W. M. Sinclair, *Memorials of St. Paul's Cathedral.*

St. Peter's Port, or St. Pierre le Port, capital of Guernsey, on the east coast of the island. St. Peter's Port trades chiefly in fruit, vegetables, and fish. Pop. 18,000.

Saint-Pierre (saṇ-pi-ār), Jacques Henri Bernardin de, French author, born 1737, died 1814. His *Études de la Nature*, published in 1788, first secured him a literary position. Then followed his chief works: *Paul et Virginie* (1787) and *La Chaumière Indienne* (1790), both of them (especially the former) very popular.

St. Pierre (pi-ār), the largest island of a small group near the southern coast of Newfoundland, forming with the adjacent Miquelon group a colony of France. The inhabitants subsist entirely by the cod-fisheries and the industries connected with them. The town of St. Pierre, on the island of that name, is the capital of the colony. Area of St. Pierre group, 10 sq. miles; pop. (1921), 3420. See *Miquelon*.

St. Pierre (pi-ār), a town on the north-west coast of the French island of Martinique, in the West Indies, totally destroyed by the terrific eruption of the volcano Mont Pelée in 1902. It was a fortified seaport, and had 26,000 inhabitants.

St. Quentin (káṇ-taṇ), a town of France, in the department of Aisne, on a height above the Somme. On account of its position on the frontiers between France and the Low Countries it figures much in history. Most of the town was destroyed during the European War. The staple manufactures are cotton and woollen goods. Pop. 55,000. See *European War*.

Saints, a word used in the New Testament as a general term to designate all the members of the Christian community, and believers in the gospel of Jesus Christ. In a specific sense it signifies persons whose lives have been deemed so eminently pious that the Greek and Roman Catholic Churches have authorized practices of commemoration and invocation in regard to them. According to the Council of Trent, " the saints reigning with Christ offer their prayers for men to God"; and it teaches that " it is good and useful to call upon them with supplication, and in order to obtain benefits from God through Jesus Christ, who alone is our Redeemer and Saviour, to have recourse to their prayers, help, and aid". As to how the saints are enabled to hear prayers addressed to them, there is no definite teaching. The doctrine of saints, and the ideas and usages which grew out of them, form one of the main points of difference between the Protestants and the adherents of the abovementioned Churches. The Roman Catholics regard their beliefs on the subject of saints as supported by different parts of the Bible and the writings of many of the early Fathers. Protestants generally object to the whole doctrine, alleging that not only is the idea of saints as intercessors nowhere contained in the Bible, but that it originated centuries after the establishment of Christianity; and that it is against the chief doctrine of Christianity, which declares all men to be sinners, and to be saved only by Christ. Countries, cities, arts, trades, orders, things, &c., have their *patron saints*, or saints who are supposed to be specially interested on their behalf. St. Denis is the patron of France; St. George of England and Russia; St. Andrew of Scotland; St. Patrick of Ireland; Olaf of Norway; Canute of Denmark; Nepomuk of Bohemia; Cecilia of music; Hubert of hunting; Crispin of shoemakers; &c.—BIBLIOGRAPHY: F. W. Faber (editor), *Lives of the Saints and Servants of God*; S. Baring-Gould, *Lives of the Saints*; Mrs. A. B. Jameson, *Legends of the Monastic Orders*.

Saint-Saëns, Charles Camille, French composer, was born in 1835, and died in 1921. He was a precocious musician, and won his first success with an ode to Saint Cecilia, which gained a prize in open competition. This was in 1852, when the composer was seventeen. In 1871 he made his first appearance in London, and so commenced a long and happy association with this country. Saint-Saëns's outstanding qualities as a composer are clarity, perfection of form, and faultless technic. He played a prominent part in the renaissance of French music, which began in the early 'seventies, and has achieved some world-wide successes as a composer, the most notable being his opera *Samson and Delilah* (1877). His symphonic poems for orchestra are also deservedly popular.

Saint-Simon (saŋ-sē-mōŋ), Claude Henri, Comte de, French economist, born at Paris in 1760, died in 1825. At the age of eighteen he entered the army, served in the closing campaigns of the American War, was made prisoner in the naval combat in which the French were defeated by Rodney, and remained as such at Jamaica till the peace in 1783, after which he returned to France and abandoned the army. He conceived the idea of regenerating humanity, and in order to qualify himself for this he engaged in extensive studies, and travelled in England and Germany. His socialistic theories are expounded in his works *L'Industrie, ou Discussions politiques, morales et philosophiques* (1817–8) and *Parabole* (1819). Augustin Thierry, Saint Aubin, and Auguste Comte, who had become his disciples, collaborated in these later volumes. Comte, however, separated himself from St.-Simon on account of the theological element which the latter grafted upon his socialistic doctrines, a change which led to the production of the *Catéchisme Industriel* (1824), and *Le Nouveau Christianisme* (1825).—Cf. A. J. Booth, *Saint-Simon and Saint-Simonism*.

Saint-Simon, Louis de Rouvroy, Duc de, French memoir writer, born 1675, died 1755. He was brought up on terms of intimate friendship with the duc d'Orleans, and when the latter became regent he was appointed a member of the regency council. He succeeded in getting himself well informed about all the court cabals, and the doings and sayings of almost every notable personage of the France of the period. This information he communicated in his *Mémoires*, published posthumously, which have made him famous. The first satisfactory edition appeared in 1856–8 (20 vols.).

St. Thomas, a Portuguese West African island, in the Gulf of Guinea. See *Sao Thomé*.

St. Thomas, a West Indian island, belonging to the United States, one of the Virgin group, 36 miles east of Porto Rico. Area, 33 sq. miles; pop. 10,700; capital, Charlotte Amalie (pop. 7747).

St. Thomas was discovered by Columbus in 1493, and was in possession of the Danish West India and Brandenburg Companies successively between 1671 and 1754, when it passed to the Crown of Denmark. The latter country sold the island, together with the rest of the Virgin group (q.v.), to the United States in 1916–7.

St. Thomas, a city of Ontario, Canada, the capital of Elgin county, near Lake Erie. There are railway shops, agricultural machinery works, flour-mills, &c., and the city is a centre of the Ontario fruit trade. Pop. 14,000.

St. Vincent, a British West Indian island, in the centre of the Windward group. Area, 150 sq. miles; pop. about (1921) 44,458; capital, Kingstown, on a bay of the same name near the south-west extremity of the island, with a pop. of 3840. The centre is mountainous (highest peak about 4000 feet). In the north-west is an active volcano, called the Soufrière, about 3000 feet high, with an immense crater; an eruption in 1902 caused great damage in the island. Sea Island cotton is produced, and is the finest in the empire; arrowroot, sugar, rum, spices, and cocoa are other products, the first being of especial note.

St. Vincent was discovered by Columbus in 1498, and first became a British colony in 1763; from 1779 to 1783 it was held by the French.

St. Vincent, Cape, a promontory forming the south-west extremity of Portugal. It is celebrated in naval history for the great victory gained here in 1797 by the British admiral Sir John Jervis over a Spanish fleet nearly twice the strength of his own.

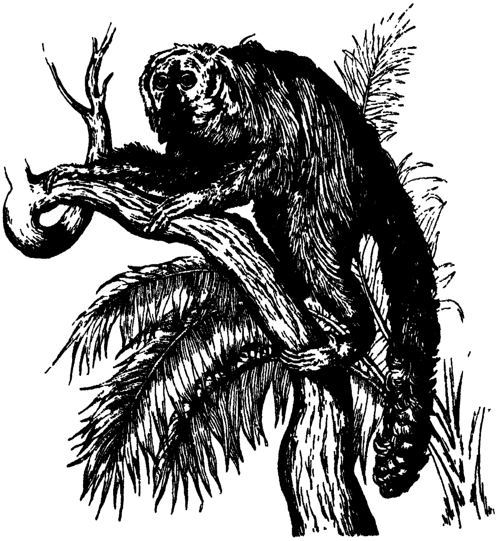
St. Vitus's Dance, or **Chorea**, a functional disorder of the nervous system which occurs chiefly among young persons, of whom it attacks girls two or three times as often as boys. The disorder is characterized usually by the performance of irregular, spontaneous movements of the face, tongue, trunk, and limbs. These movements are increased during the hours of wakefulness by excitement and by voluntary movement. They do not occur during sleep. A child exhibiting the characteristic features of the disease has the appearance of one excessively naughty, fidgety, and restless. While fright or other strong emotion is the exciting cause in many cases, the condition is now regarded as one of the numerous manifestations of rheumatism. The speech is often affected, the mental functions rarely so, by the disease, which lasts for weeks or months, is likely to recur, and almost always ends in complete recovery. Certain affections of the heart are, however, common complications. The popular name arose from association of the symptoms of *chorea* with those of the sufferers in an epidemic of dancing mania whom the authorities of Strasbourg, some 500 years ago, sent to the Chapel of St. Vitus at Saverne for cure.

Sais, a ruined city of Egypt, near the right bank of the Rosetta branch of the Nile, 67 miles north-west of Cairo, formerly a place of great importance.

Sakai, a seaport of Honshu, Japan, on the Inland Sea, 6 miles from Osaka. There is a fishing industry, iron-founding, brick-making, and the manufacture of cutlery. Pop. 75,350.

Sakhalin and Karafuto, an island of the North Pacific off the coast of Siberia. The northern part is Russian; south of 50° N. lat. it is Japanese, and is known as Karafuto. There are three mountain ranges, viz. north-central, western (along the Gulf of Tartary), and eastern (along the Sea of Okhotsk). A central plain extends across the island along the valleys of the Tim and Poronai, the two chief rivers. The climate is severe, July and August having a mean temperature of about 63° F., and January between 12° and 0·4° F., but dense sea-fogs are the worst feature. Scurvy and malaria are prevalent. Alexandrovsk is the Russian administrative centre; Toyohara (pop. 12,900), the Japanese capital. Other Japanese towns are Otomari (16,000), a treaty port; Mauka (19,000), the second port, ice-free all the year round; Manue; and Kismani. There are large forests in Sakhalin and Karafuto; fisheries are important; coal (lignite) from Due and Vladimirsk in Sakhalin, and from Sertonai in Karafuto, is the chief mineral.

Originally Japanese, Sakhalin passed entirely to Russia in 1875, in exchange for the Kurile group, but was reconquered during the Russo-Japanese War of 1905, when the southern half of the island passed again to Japan. Since then, the Russian and the autochthonous populations have dwindled, but immense numbers of Japanese have emigrated to Karafuto, where the pop. is 105,800; area, 13,148 sq. miles. No statistics are available for Sakhalin.



Saki (*Pithecia monachus albicans*)

Saki, the common name of several species of monkeys inhabiting South America, closely allied to the sapajous (q.v.), but differing from the latter in having non-prehensile tails. They are all forest-dwellers, gregarious, nocturnal, timid, and live chiefly on honey and fruits.

Sâl (säl), one of the most valuable timber trees of India, *Shoræa robusta*, nat. ord. Dipteraceæ, growing to the height of 100 feet. Extensive forests of it exist in Northern India, where it is largely used in carpentry of all kinds, the wood being light-brown in colour, hard, and uniform in texture. See *Dammar Resin*.

Sala, George Augustus, British journalist, born in 1828, died in 1895. He was a voluminous contributor to the newspaper press, often as special correspondent. Much of his work was contributed to *The Daily Telegraph*, but *All the Year Round*, *The Cornhill Magazine*, and *The Illustrated London News* contained many sparkling productions from his pen.

Sal'adin, Sultan of Egypt and Syria, born 1137, died 1193. His father, a native of Kurdistan, was Governor of Tekrit (on the Tigris). On the caliph's death in Egypt (1171) Saladin usurped his wealth and authority, with the approval of Nureddin, the Sultan of Damascus. After the latter's death (1173) Saladin succeeded also in possessing himself of Damascus and Southern Syria. He rapidly extended his conquests over Syria and the neighbouring countries, and thus came in contact with the Crusaders during the Third Crusade. The disastrous defeat he suffered from the Crusaders in 1177 compelled him to return to Egypt, but in 1182 he resumed his career of conquest. In 1187 he gained the famous victory of Tiberias, and Jerusalem surrendered to him after a gallant resistance. But the fall of Acre in 1191 after a two years' siege, and defeats at the hand of Richard I, compelled Saladin to conclude a truce (1192), which was followed by the withdrawal of Richard. About a year after this event Saladin died at Damascus. He was a skilful, brave, and magnanimous general; and an astute, beneficent, and merciful ruler. Saladin was the founder of the dynasty of the Ayoubites. The Arabic form of the name is *Sala-ud-din*. See *Crusades*.

Sala'do, a river of the Argentine Republic, in the province of Buenos Aires, which rises on the eastern slopes of the Cordilleras, and falls into the River Plate after a course of 420 miles.

Salaman'ca, a frontier province of Eastern Spain whose boundary marches on the west with that of the north-east Portuguese province of Baixa. Oil, wine, hemp, and cereals are produced in the north; the south is hilly and forested, with beech, oak, pine, and chestnut. Live-stock and timber are the principal exports. Area, 4829 sq. miles; pop. 333,450.

Salamanca (ancient **Salmantica**), a city of Spain, capital of the modern province of Salamanca, on the Tormes. In picturesqueness, and in the magnificence of its ancient edifices, Salamanca is hardly surpassed by any other Spanish city. Chief among the numerous attractions rank the New Cathedral (*Catedral Nueva*), begun in 1509 and completed in 1733; the Old Cathedral (*Catedral Vieja*), or *Santa Maria de la Sede*, founded by Raymond of Burgundy in 1100 and finished a century later; and the university, originally built between 1415 and 1433, which is one of the oldest and most celebrated in Europe, and attracted at one time some 15,000 students from all parts of Europe. Pop. (1918), 28,931.

Salmantica, a large and ancient city of the Vettones, was taken by Hannibal in 222 B.C., and under the Romans it became a military station. In modern times Salamanca is chiefly celebrated for the victory gained in its vicinity on the 22nd July, 1812, by the Anglo-Portuguese army under the Duke of Wellington over the French under Marshal Marmont.

Salaman'der, the name given to various animals of the class Amphibia (frogs, toads, newts, &c.), and order Urodela (tailed'), including the land salamanders (genus Salamandra) and the water salamanders, efts or newts. The lizard-like land salamanders have glands which secrete a watery fluid, which the animal exudes when alarmed, but which is injurious to small animals only. The best-known species is the *Salamandra maculosa*, the common salamander of Europe. It is 6 to 8 inches long, is found in moist places under stones or the roots of trees, near the borders of springs, in deep woods, &c., and passes its life in concealment except by night or during rain. It is sometimes called the *spotted salamander*, from the black patches on its bright-yellow skin. There are various other species in Europe, Asia, and America. In America the name is often given to the 'hellbender' (*Cryptobranchus alleghaniensis*). The

Spotted Salamander (*Salamandra maculosa*) giant salamander of Japan (*C. japonicus*) is closely allied. Salamanders feed on worms, slugs, snails, and insects.

Sal'amis, or **Koluri**, an island of Greece, in the Gulf of Ægina, close to the shore of Attica. It has a rocky surface, with a thin but not unproductive soil, and in some parts is well adapted for the olive and vine. The Persian fleet under Xerxes was defeated at Salamis by the Greeks in 480 B.C.

Sal-ammoniac, or **Ammonium chloride**, NH_4Cl, a salt of ammonia obtained in the crude state as a by-product in the manufacture of coal-gas, by neutralizing the ammoniacal liquor with hydrochloric acid. The salt may be purified by sublimation, when it is obtained as a tough, fibrous white mass. It is used in calico-printing, galvanizing iron, soldering, and in electric batteries.

Salandra, Antonio, Italian statesman, was born in 1853, and in 1886 entered the Italian Parliament as Conservative member for Lucera. On the fall of the Giolitti Cabinet, Salandra came into power (March, 1914), and headed the Government which ranged Italy on the side of the Allies during the European War. Adverse criticism caused his resignation in June, 1916.

Sale, Sir Robert Henry, British soldier, born 1782, died 1846. He distinguished himself in Afghanistan, where he forced Dost Mohammed Khan to surrender, and inflicted a crushing defeat upon Akbar Khan at Jelalabad (1842), after he had been besieged for several months, subsequently assisting in the recapture of Kābul.

Salem, a city and port of entry of Massachusetts, United States, one of the county seats of Essex county, on Salem Harbor, an arm of Massachusetts Bay. Salem formerly had a considerable foreign trade, especially with the East Indies and China, and has still a large coasting trade in coal, although its manufacturing industries are now of most importance. These include leather and boots, cotton, jute, and silverware. Pop. 55,530.

Salem has many interesting buildings, and played a prominent part in the earlier history of the United States. It is one of the oldest towns of the Union, founded in 1626, and became a city in 1835.

Salem, a city of Oregon, United States, the state capital and the county seat of Marion county, on the Willamette River; served by the Southern Pacific Railway, and by electric-traction lines and steamships to Portland. It stands in the heart of the Willamette Valley, a rich farming and fruit-raising area for which it is the market. Salem was founded about 1840, became a city in 1858, and state capital in 1860. Pop. 17,680.

Salem, a district and city of India, in Madras Presidency. The district is traversed from E.S.E. to W.N.W. by a great range of hills pierced by four passes, rich in iron and in beds of white magnesite. The Cauvery is the chief river; it traverses the western and southern boundaries. Weaving is the principal industry; silk cloths and cloths with silk borders are woven everywhere. Salem city is the head-quarters of the district. Area of district, 6800 sq. miles; pop. 1,767,000; pop. of city, 50,000.

Sale of Goods. The law of sale is contained in the Sale of Goods Act, 1893. The term *goods* is defined as comprising all corporeal movables except money. Great importance attaches to the time when the property in the goods is deemed to pass, for, as the Latin maxim puts it, 'res perit domino' (a thing perishes to its owner). The rules are:

(*a*) Specific or ascertained goods: the property passes when contract is made if goods are in a deliverable condition, though payment or delivery is postponed. If goods are not in a deliverable state at the time, the property passes when the buyer is advised that the goods are ready.

(*b*) Goods sold 'on approval' or 'on sale or return': the property passes when buyer signifies acceptance or otherwise adopts the transaction.

The motto 'caveat emptor' (let the buyer beware) must always be kept in mind. Thus a person buying a horse must remember that a seller does not require to point out any bad features, but at the same time he must not give misleading information. In some cases a certain warranty is implied, as when goods are ordered to suit the requirement of a special market. Certain rights are possessed by an unpaid seller, viz. (1) *lien*, the right to retain goods sold until the price is paid; (2) *stoppage-in-transitu*, the right, where the buyer is insolvent, to stop the goods in transit, so as to retake possession. An insolvent person is defined by the Act as one who either has ceased to pay his debts in the ordinary course of business, or cannot pay them as they fall due, whether he has committed an act of bankruptcy or not. Where notice to stop the goods is given to the carriers, time must be allowed to advise sub-agents. The unpaid seller has also (3) the right of *re-sale*, where such right has been expressly reserved or where the buyer is in breach of agreement. This remedy is often required where perishable goods are sold and the buyer fails to take delivery or to pay the price.

In actions for damages the measure of damages is, usually, the loss directly and naturally arising. The court, instead of granting damages, may, if craved, order specific performance. Apart from contract, express or implied, the place of delivery is the seller's place of business.

Salep, a drug obtained from the tuberous roots of several species of Orchis, especially *O. mascŭla.* It is much valued in the East for its supposed general stimulant and nutritious properties.

Salerno, a maritime department of Campania, South Italy, with a coast-line on the Tyrrhenian Sea. It is traversed generally by spurs of the Apennines. Cereals, hemp, flax, cotton, oil, wine, tobacco, and fruit are produced. The capital is Salerno. Area, 1908 sq. miles; pop. 571,800.

Salerno (ancient **Salernum**), a city of Campania, South Italy, capital of the department of Salerno, on the Gulf of Salerno (an arm of the Tyrrhenian Sea); served by the railway from Naples. It is the seat of an archbishop, and has a cathedral (San Matteo) built by Robert Guiscard in 1084, and restored in 1768. Behind the town, on a hill (900 feet altitude), stand the ruins of the ancient castle of the Lombard princes. The Corso Garibaldi, the chief promenade, occupies the seaward portion of the site of the city walls. Pop. 48,250.

During the Middle Ages the town was noted for its medical school, the Schola Salernitana, at one time the most famous in Europe.

Sales, Saint François de, Bishop of Geneva, born 1567, died 1622. His *Introduction à la Vie dévote* has been translated into all the leading languages of Europe. In 1665 he was canonized by Pope Alexander VII, and (1923) became patron saint of Christian writers.

Saley′er Islands, a group of islands in the Malay Archipelago, south of Celebes. They are about seventy-three in number, have a population of about 80,000 Mahommedan Malays governed by native rajahs under a Netherlands agent. Ebony, teak, indigo, coffee, earth-fruits, and cotton are among the products.

Salford, a county and municipal borough of Lancashire, England, on the Irwell, which divides it from Manchester; served by the London & North-Western and Midland Railways. The chief manufactures are in textiles, the various industries being practically identical with those of Manchester; the docks of the Manchester Ship Canal are within the borough. It may be considered an integral portion of Manchester, though it has a mayor and corporation of its own. Pop. (1921), 234,150. See *Manchester.*

Salica′ceæ, a natural order of apetalous dicotyledons, distinguished by a two-valved capsule, and numerous seeds tufted with long hairs. The species are trees or shrubs, inhabiting woods in the northern districts of Europe, Asia, and America. Only two genera are included in the order, Salix or willow, and Populus or poplar.

Sal′icine, a bitter crystalline substance obtained from the bark of willows, and used in medicine, especially in the treatment of rheumatic fever and neuralgia. It is soluble in hot water.

Salic Law. The Salic law was the law of the Salian Franks, codified by Clovis (died 511), but the term is familiarly employed to designate the application to questions of successions to kingdoms of a rule (itself an addition to Salic law) restricting to males the succession to certain lands. The Salic law in this sense was an antiquarian device used for political purposes by French lawyers in 1316 in order to prevent the succession of a woman to the throne. The principle was followed not only in 1316 in the case of Philip V of France, but also in 1322 and 1328 at the accessions of Charles IV and Philip V. It was challenged by Edward III of England, who claimed the French throne through his mother, and the English invasion completely established the 'Salic law' as the rule of succession in France. It was also followed in some of the German states, and the separation of Great Britain from Hanover in 1837 is the most important modern instance of its operation.

Salicyl′ic Acid, or **Ortho-hydroxy-benzoic Acid**, $C_6H_4(OH)\cdot COOH$, an organic acid occurring in nature in the flowers of the meadow-sweet, in whortleberry, and, in the form of its methyl ester, in oil of winter-green. It is usually manufactured by saturating the sodium salt of phenol with carbon dioxide under pressure, and heating to 120° to 140° C. When pure, salicylic acid is a white crystalline substance, melting at 157° C. It sublimes if carefully heated. It is sparingly soluble in cold water, more readily in hot water and in alcohol. It has strong antiseptic properties, and is used in the manufacture of certain azo-dyes and in medicine. The sodium salt is a popular antirheumatic, and the acid itself, in concentrated solution, removes corns and warts.

Salisbury (sa̧lz′be-ri), Robert Arthur Talbot Gascoyne Cecil, third Marquess of, English statesman, born 1830, died 1903. He was educated at Eton and Oxford. As Lord Robert Cecil he entered Parliament as member for Stamford in 1853, and in 1866 was appointed Secretary of State for India. In 1865, on the death of his elder brother, he became Lord Cranborne and heir to the marquessate. Owing to difference of opinion on the subject of the franchise he retired from the ministry, but on the death of his father in 1868, and his consequent elevation to the House of Lords, he returned to his old party associations. He resumed the Secretaryship for India in the Disraeli Government of 1874. At the end of the Russo-Turkish War, having become Foreign Minister, he insisted on the treaty which Russia had forced on Turkey being submitted to a congress of the Powers. In 1878 he accompanied Disraeli to the congress at Berlin, and on the death of that statesman became the recognized leader of the Conservative party. He became Premier as well as Foreign Secretary on the fall of the Gladstone Government in 1885. Gladstone succeeded again to power in the end of the same year, but in June following was defeated on the Irish Bills, when Lord Salisbury again became Premier and Foreign Secretary, with the approval and support of the Liberal Unionists. This position he held till 1892, and in 1895 he entered on a third term as Premier. In 1900 he became Premier for the fourth time, but he retired from political life in 1902.—Cf. F. D. How, *The Marquis of Salisbury.*

Salisbury, or **New Sarum,** an ancient city and municipal borough of Wiltshire, England, on the Avon, where it is joined by the tributaries Bourne and Nadder (with the Wiley); served by the London & South-Western and the Great Western Railways. The city possesses a magnificent cathedral, built between 1220 and 1263. The spire (404 feet) was added between 1335 and 1375, and is the highest in England. There are several other churches, a bishop's palace, court-house, corn-markets, and a museum. Salisbury is a brewing and military centre. Pop. (1921), 22,870.

Salisbury, a city of Rhodesia, the capital of Southern Rhodesia, 4800 feet above sea-level. As Fort Salisbury, the city was founded in 1890, and is named in honour of the then Imperial Prime Minister.

Salisbury, a city of North Carolina, United States, the county seat of Rowan county; served by the Southern Railway. The city has varied manufactures, and is the entrepôt for the surrounding agricultural region. Pop. 13,000.

Sali′va is a transparent watery fluid of a somewhat slimy consistence found in the mouth, and derived from the different salivary glands, and from the numerous minute mucous glands of the mouth. The salivary glands, known as the parotid, submaxillary, and sublingual, are bilateral, and are found in the neck and sides of the face. The saliva has a double action—physical and chemical. The former consists in moistening the lining of the mouth, aiding in the solution of the soluble substances of the food, and, by lubricating the whole content of the food, helps swallowing. The chemical action is due to the presence of an enzyme, ptyalin, which acts by breaking up starch and converting it into dextrin and maltose. It has been discovered that the salivary digestion continues in the stomach for some time, until it ceases on account of the hydrochloric acid secreted by the glands of the stomach. The secretion of saliva is normally a reflex action, and is principally stimulated by taste.

Sallow-thorn (Hippophaë), a genus of plants of the nat. ord. Elæagnaceæ. *Hippophaë rhamnoides*, sea buckthorn, a spiny shrub with diœcious flowers and small orange-coloured berries, growing on cliffs near the sea, is the only species found wild in Great Britain.

Sallust (Gaius Sallustius Crispus), Roman historian, was born at Amiternum in 86 B.C., and died in 34 B.C. His family was plebeian but wealthy. He entered public life, and became a tribune of the people in 52 B.C. He was a strong supporter of Cæsar, to whom he owed the influential positions which he held. He was removed from the Senate in 50 B.C., the alleged reason for his removal being his gross immorality, though the real reason was probably his friendship for Cæsar. Cæsar's enemies would have said that the latter reason implied the former. Sallust was reinstated in 49 B.C.; three years later he accompanied Cæsar to Africa, and was made Governor of the province of Numidia. He returned to Rome with enormous wealth, and purchased the famous gardens known as the Horti Sallustiani, where he lived in great luxury, and devoted himself to the study of history.

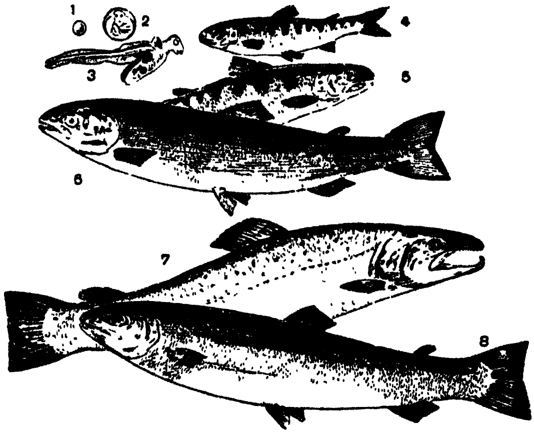
It is unfortunate that Sallust's longest and most important work is lost. It was known as *Historiæ*, and was a history of Rome from 78 B.C. to 67 B.C. Only inconsiderable fragments (some discovered in 1886) survive; but they are enough to ensure regret at the loss of the complete work. Sallust is only known by two short but brilliant monographs, *Bellum Catilinarium* and *Bellum Iugurthinum*. In these two books he shows himself to be the founder of a new school of Roman historians; he is both more scientific and more literary than his predecessors. He did some careful research work, consulting even some Carthaginian records in King Hiempsal's library, and wrote in a terse and vivid style, a striking contrast to the dry narrative style of the old annalists. His characters are alive, and in his speeches he shows dramatic and not merely literary ability. He is a lover of truth, though the saying of Aristotle about Plato might be inverted and applied to him—amica veritas sed magis amicus Cæsar. In his style he imitated Thucydides, with whom Quintilian, the soundest of Latin critics, did not hesitate to compare him. He was usually considered the greatest of Roman historians.

Salma′sius, Claudius (the latinized name of Claude de Saumaise), French scholar, born in 1588, died 1653. In 1631 he succeeded Joseph Scaliger as professor in Leyden University. In 1649 he wrote a defence of Charles I (*Defensio Regia pro Carolo I*), which was brilliantly answered by Milton's *Defensio pro Populo Anglicano.*

Salmon, George, British mathematician, was born in 1819, and died in 1904. He was regius professor of divinity in Dublin University from 1866 to 1888, when he became provost of Trinity

College. He wrote valuable textbooks, which are still standard works, on conic sections, analytic solid geometry, higher algebra, and higher plane curves.

Salmon (*Salmo salar*), a well-known fish, forming the type of the family Salmonidæ (q.v.), ranging from North Europe to the Bay of Biscay, and from Greenland to Cape Cod. The salmon inhabits both salt and fresh waters, and ranks high among the food-fishes of Britain and other countries. It generally attains a length of from 3 to 4 feet, and an average weight of from 12 to 30 lb., but these limits of size and weight are frequently exceeded. The typical colour of the adult fish is a steel-blue on the back and head, becoming lighter on the sides and belly. Teeth are present in the upper and lower jaws, palate, and vomer or roof of the mouth; the edges of the tongue are also toothed or notched. The food consists of animal matter, but when in fresh water the adult fish does not feed. In the autumn the salmon quits the sea and ascends the rivers for the purpose of spawning, often surmounting considerable obstacles, such as waterfalls, in its progress. In many streams they are now assisted in this by artificial structures known as 'salmon-ladders'. The eggs are deposited in a shallow trough or groove excavated in the gravelly bed of the river. After spawning, the salmon, both male and female, return to the sea under the name of *spent-fish, foul-fish,* or *kelts,* the females being further distinguished as *shedders* or *baggits.* In from 70 to 150 days the young fish emerges from the egg. In its embryo state it is not unlike a tadpole, being on the average about 1½ inches in length. About 50 days later the salmon-fry or *alevin* assumes the appearance of a fish and approaches the definite or *parr* stage of its existence, beginning to be marked by transverse bars of dark colour. It usually continues in the shallows of its native stream for two years after hatching, and during this period it attains a length of 8 inches. When the season of its migration arrives, generally between March and June, the fins have become darker and the fish has assumed a silvery hue. It is now known as a *smolt.* The smolts congregate into shoals and proceed leisurely seaward. On reaching the estuary they remain in its brackish water for a short time and then make for the open sea. Leaving its native river as a fish weighing it may be not more than 2 oz., the smolt, after twelve months' absence, may return to fresh water as a *grilse,* weighing 4 or 5 lb. In the grilse or *salmon peal* stage the fish is capable of depositing eggs. After spawning in the fresh water the grilse again seeks the sea in the autumn, and when its second stay in the ocean is over it returns after a few months' absence as the adult salmon, weighing from 8 to 10 lb. The salmon returns as a rule to the river in which it passed its earlier existence. The fertility of the fish is enormous; it has been calculated that over 150,000,000 of salmon ova are annually deposited in the Scottish River Tay alone, of which only about a third develop and attain the parr stage, whilst of these parrs only 20,000,000 become smolts; and in time only 100,000 remain as perfect salmon, of which 70,000 are caught and 30,000 left for breeding purposes. The chief salmon fisheries are those of the Tweed, Tay, North Esk, Dee, Spey, Severn, and some Irish rivers; there are important fisheries in some European and North American rivers. In the waters of North-Western America are several salmon belonging to a distinct genus, Onchorhynchus, including the quinnat or king-salmon, blue-back salmon or red-fish, silver salmon, dog salmon, and hump-back salmon. The quinnat (*O. tchawytcha*) has an average weight of 22 lb., but sometimes reaches 100 lb. Both it and the blue-back salmon (*O. nerka*) are caught in immense numbers in the Columbia, Sacramento, and Frazer (especially in spring), and are preserved by canning. Attempts have been made to introduce the quinnat into eastern North America and Europe. The Oriental salmon (*O. orientalis*) of Kamchatka is an allied species. The salmon is one of the fishes that are important objects of pisciculture (q.v.), and various species of the family have been introduced into waters not previously inhabited by them. Large numbers are sometimes destroyed by a skin disease caused by a fungoid growth (Saprolegnia).



Salmon (*Salmo salar*)

1, Egg. 2, Egg with embryo. 3, Young larva with yolk-sac. 4, Parr. 5, Smolt. 6, Grilse. 7 and 8, Adult male and female.

Salmon'idæ, a family of teleostean fishes, belonging to the soft-finned sub-order Malacopterygii. To this family belong the various species of salmon (q.v.), the trouts, the char, the grayling, the smelt, the vendace, white-fish of America, &c. The ventral fins are placed far back on the body. There are overlapping cycloid scales; the head is naked, and there are no barbels. The belly is rounded, and there is a small adipose fin behind the dorsal. Pyloric appendages of the stomach are generally numerous and rarely absent. The air-bladder is large and simple. The ova fall into the cavity of the abdomen before exclusion. Salmonidæ are inhabitants of the sea or fresh water, or both.

Salmon - trout, or **Sea - trout,** trout that have been to the sea. Unlike salmon they feed voraciously in fresh water. The east-coast form (*Salmo albus*) differs somewhat from the west-coast type or sewen (*S. cambricus*), also found on the Irish coast.

Salon, a room for the reception of guests or company, and also for a periodical reunion of men and women for social or conversational purposes. The first famous salon was that of the Hôtel de Rambouillet, which lasted from 1608 to 1659. Other salons were those of Madame de Scudéry in the Rue Beauce, frequented, among others, by Balzac and Madame de Sévigné; the salons of Madame de Sablé, of Ninon de l'Enclos, and of Madame Scarron (afterwards Madame de Maintenon) in the seventeenth century; of Mademoiselle de Lespinasse, Madame Necker, and Madame Roland in the eighteenth; and of Madame de Staël, Madame Récamier, and Madame Vigée-Lebrun in the nineteenth century.

Saloni′ka (ancient **Thessalonica**), a city of Greece, at the head of the Gulf of Salonika, the principal port for Macedonia and Greater Serbia; at one time capital of the Turkish vilayet of Salonika (*Selanir*) and the second port of the Ottoman Empire. The industries are miscellaneous, and none is outstanding; cotton- and woollen-mills, brewing, soap-factories, foundries, flour-mills, a 'raki' distillery, tanneries, and manufactures of leather goods may be mentioned. Anthracite deposits exist near the city. Pop. 170,195 (mainly Jewish). The department of Salonika has a population of 398,240, as against the population of 1½ millions comprised in the old Turkish vilayet which was divided between Bulgaria, Serbia, and Greece at the conclusion of the second Balkan War.

During the European War (q.v.) Salonika became the base of the Allied army operating against Bulgaria and the Central Powers The first troops landed in Oct., 1915, and an attempt to effect a junction with the remnants of the Serbian army failed, mainly through the difficult nature of the country, the lack of communications, and a shortage in personnel. See *European War*, under sections devoted to summaries of the Balkans campaigns.

Salpa, a genus of ascidian or tunicate animals, the type of the family Salpidæ. These animals are found floating in the Mediterranean and the warmer parts of the ocean, and are protected by a transparent gelatinous coat, perforated for the passage of water at both extremities. They are frequently phosphorescent, and afford a typical case of alternation of generations, there being an *asexual* solitary form that produces a chain of *sexual* forms by budding.

Salpiglossis, a genus of South American herbs, order Solanaceæ. *S. sinuata*, a half-hardy annual, bears handsome flowers in a great variety of colours.

Sal′safy (*Tragopogon porrifolius*), belongs to the nat. ord. Compositæ, and is allied to the endive and dandelion. It is cultivated for the sake of its long, white, fleshy roots, which are cooked and served in various ways.

Salsette′, a large island to the north of Bombay Island, with which it is connected by a bridge, causeway, and railway embankments. Area, 246 sq. miles. A broad range of hills runs along the centre of the island from north to south (Thána peak, 1530 feet altitude), while the lowlands are much intersected by tidal creeks. There are no large streams, and water is obtained from wells. The staple crops are rice and grass. The coast abounds in coco-nut groves, and the palmyra-palm grows plentifully. The island is remarkable for its cave architecture. The chief towns are Bándra (pop. 22,000); Thána (16,000), the administrative head-quarters; and Kurla (15,000).

Salsil′la, a name of several amaryllidaceous plants producing edible tubers, and belonging to the genus Bomarea, or to the closely-allied genus Alstrœmeria. One species (*B.* or *A. edūlis*) is cultivated in the West Indies, its roots being eaten like the potato.

Sal′sola, saltwort, a genus of plants of the nat. ord. Chenopodiaceæ, comprising about forty species of mostly hardy herbs, shrubs, or sub-shrubs. The ashes of *S. Kali*, the prickly saltwort, a British plant, and of *S. Soda*, a south European and North American species, were formerly much used in the production of an impure carbonate of soda, known as *barilla*.

Salt, or common salt, consists of sodium chloride, NaCl, and is one of the most abundant and widely distributed substances known. It occurs in enormous deposits in the solid state as rock-salt (q.v.), and is also present in solution in salt lakes, brine springs, and sea-water. Rock-salt occurs in England principally at Northwich, Droitwich, Middlesborough, and also in parts of Lancashire. There are large deposits in Galicia, Germany, the United States, Chile, and Peru. It is generally found in stratified layers, which have a reddish colour owing to the presence of iron oxide and other impurities. If the salt is sufficiently pure, it is mined directly, but the usual method consists in sinking borings through the upper strata of rock and allowing water to penetrate to the salt-beds below, the brine being then brought to the surface by pumping. The brine is allowed to settle and evaporated in iron pans, but in some cases it is previously treated with milk of lime to precipitate compounds of calcium, magnesium, iron, and aluminium. The finest salt is obtained by boiling the brine in small pans and collecting the first deposits at short intervals. Coarser varieties, such as 'fishing' salt, 'freezing' salt, and 'bay' salt, are produced in larger pans and at lower temperatures.

In warm climates, as on the shores of the Mediterranean, salt is obtained by the evaporation of sea-water in large shallow pools or 'salterns' constructed on the sea-shore and exposed to the sun's rays. As the brine concentrates, the crystals of salt are raked off and allowed to drain in heaps. The mother-liquors or 'bittern' are sometimes utilized for the extraction of the bromine and iodine which they contain. In arctic regions salt may be obtained from sea-water by freezing, whereby the brine becomes richer and richer in salt, whilst almost pure water separates out as ice. The saturated brine is then evaporated by means of heat. In many countries where natural salt-springs occur, the preliminary evaporation is carried out by pumping the weak brine to the top of large wooden structures filled with brushwood and termed 'graduators', which are placed so that the prevailing wind blows across them. In trickling through the pile, the brine exposes a large surface to the air, and rapidly becomes sufficiently concentrated for further evaporation by means of heat. During the process the less soluble constituents, such as iron oxide, calcium sulphate, calcium carbonate, &c., separate out on the brushwood as 'thornstone'.

Salt prepared by the above methods always contains small quantities of other salts, such as sodium sulphate, calcium sulphate, and calcium and magnesium chlorides. The presence of these last two substances, which are strongly hygroscopic, causes the salt to become moist, especially in damp weather. Pure sodium chloride may be precipitated from a saturated solution of ordinary salt by adding hydrochloric acid, the other salts remaining in solution. Common salt forms colourless cubical crystals of specific gravity 2·2. About 36 parts dissolve in 100 parts of cold water, but the solubility is only increased by 3 parts on raising the temperature to boiling-point. See *Chlorine*; *Hydrochloric Acid*; *Sodium*.

Salta, a northern province of Argentina, whose frontier marches in the north with that of Bolivia. The east forms part of the Gran Chaco, and the west is a mountain area intersected by valleys of rich agricultural productivity. Gold, silver, and copper among minerals, and cereals, sugar, coffee, tobacco, and fruit in agriculture, are produced. Cattle-raising and the export of hides are important industries. Salta, on the Salta River, served by railway to Tucuman, is the capital, and has a large trade with Bolivia. Area, 48,302 sq. miles; pop. (province), 147,000; pop. (town), 34,000.

Saltaire, a town of Yorkshire (West Riding), England, on the Aire; served by the Midland Railway. It is named after its founder, Sir Titus Salt, who planted here his vast factories for the manufacture of alpaca, and built dwellings for his employees. Pop. (1921), 13,500.

Saltash, a municipal borough and seaport-town of Cornwall, England, on the Tamar. It has a coasting trade, and fishing and malting industries. The Royal Albert Bridge (1857–9) carries the railway across the Tamar; it is 2240 feet long. Pop. 4000.

Saltburn-by-the-Sea, an urban district and seaside-resort of Yorkshire (North Riding), England; served by the North-Eastern Railway (Stockton and Darlington branch terminal), to which it owes its importance. It is situated amid fine scenery on lofty cliffs facing the sea, the sands extending about 8 miles along the coast. Pop. (1921), 4670.

Saltcoats, a town and seaside-resort of Ayrshire, Scotland. It is contiguous with Ardrossan on the north, and with Stevenston on the south. On the former side there are fine sands, an extensive esplanade (about 2½ miles), and a bathing-station; on the latter is the harbour (almost purely ornamental), and the 'east beach'. Pop. (1921), 13,000

Saltillo (sȧl-til′yō), a city of Mexico, capital of the state of Coahuila, on the Tigre. It is a spa of some note, but it is also a busy industrial and trading town and railway centre. Flour and cotton and woollen goods are produced. Pop. 35,400.

Salt Lake City, a city of Utah, United States, the state capital, near the Jordan River, and 11 miles south-east of the Great Salt Lake. It stands at the base of the Wasatch Mountains, 4550 feet above sea-level. The most remarkable public buildings are the Mormon tabernacle, a large ungainly building with a roof like a dish-cover, the Mormon temple, and the State University of Utah. Salt Lake City is the metropolis of the Mormons, and was first settled in 1847 by the followers of Brigham Young. Pop. (1920), 118,110. See *Mormons*.

Saluzzo, a city of Piedmont, North Italy, in the province of Cuneo, at the foot of the Cottian

Alps. Hardware, silk, hats, and leather are among the manufactures. Pop. 10,000.

Salvador′ (*Republica de el Salvador*), the smallest and most densely peopled of the Central American Republics. *Area, &c.*—Salvador has an area of 13,183 sq. miles, divided into fourteen departments, and contains a population (1922) of 1,500,000 (mainly Roman Catholic; Mestizos, and Indians). *Towns.*—The capital is San Salvador (pop. 80,800); other towns are: Santa Ana (60,700), San Miguel (30,400), Nueva San Salvador (23,500), San Vicente (26,900), Quetzaltepeque (destroyed by seismic and volcanic disturbances in 1917; pop. 15,900), and Sonsonate (14,800). The chief ports are Acajutla, La Libertad, and La Union. *Production.*—Agriculture is the dominant industry, coffee being the main staple. Cheese, cacao, tobacco, rubber, sugar, and balsam are also important. Rice, cereals and fruit, and some cotton (fostered by the State) are raised to some extent. There is an afforested area producing dye-woods and mahogany, cedar, and walnut. In the Cordillera gold (departments of San Miguel, La Union, and Morazán), silver, copper, iron, mercury, and some coal (Lempa Valley) are found. Gold and silver are the only deposits worked commercially, and these chiefly in Morazán. Trade is divided between the United States, Britain, and France. *Government, &c.*—Legislative power is vested in a Congress of 42 Deputies (3 from each department), elected for one year by universal suffrage, and the executive power is exerted by a President, who holds office for four years. Education is nominally free and compulsory. Defensive forces comprise a mobilized personnel (78 officers and 16,000 men), a mobile personnel (49 officers and 4500 men), and a reserve (251 officers and 17,000 men), but in time of war conscription is enforced between the ages of eighteen and fifty years.

History.—San Salvador came into being, as an independent republic, through the disruption in 1839 of the Central American Federation (Guatemala, Salvador, Honduras, Nicaragua, and Costa Rica), but its actual independence of Spain dates from 1822. Only the paternal influence and guiding hand of the United States prevents Salvadorian politics from being in a perpetual ferment. In June, 1920, Salvador initiated a plan for the unification of the Central American States, and in Sept., 1921, Honduras, Salvador, and Guatemala agreed to federate, and signed the Constitution of the new Republic, to take effect as from 1st Feb., 1922. Salvador and Guatemala both withdrew, however, before the agreement took effect.

Salvado′ra, a genus of plants, type of a natural order (Salvadoraceæ) of gamopetalous dicotyledons, allied to Oleaceæ and Jasminaceæ. They have stems with slightly swollen joints, opposite entire leaves, and loose branching panicles of small flowers.

Salvage. This means either (*a*) services rendered in saving a ship or the persons or goods on board from destruction or capture at sea, or (*b*) the reward given for such services. To entitle a person to salvage reward, he must be under no legal obligation to render salvage service, other than the general obligation imposed by the Maritime Conventions Act, 1911, to give assistance to persons in danger at sea.

All services which are rendered to a ship in danger or distress, and which contribute to the saving of the ship or the lives or cargo on board, are salvage services. The giving of advice or information may be such, provided it is not given by virtue of any obligation so to do. Where the risk of danger has been caused by the salving vessel itself, the services rendered do not give rise to any claim for reward. Reward for salvage must be given by those whom the services have saved from loss, and in proportion to their interests. Ship, cargo, and freight at risk (i.e. freight not paid in advance and not due if the cargo is not delivered) all bear their respective shares according to their value. In assessing claims for life salvage no regard is had to the pecuniary value of the lives saved, but such claims have preference over all other claims for salvage.

A just and fair agreement as to the amount of the reward will be given effect to by the courts. Generally, the master of a ship has power to bind the owners in such an agreement. Where there is no agreement, the amount of salvage reward is not a fixed quantity, but depends upon the circumstances of the individual case. There are, however, several considerations which weigh with the court in fixing salvage remuneration, namely: (1) the perils from which the ship has been rescued; (2) the dangers to which the salvors have been exposed and the resource displayed by them; (3) the labour and the time expended by the salvors; (4) the value of the property salved; and (5) the loss and damage occasioned to the salving vessel.

The major portion of the salvage reward is allotted to the owners of the salving vessel, who run the greatest risk of loss; next in preference comes the master, who has the burden of the conduct of the operations; and finally come the officers and crew according to their ratings. The principle is that so far as possible the remuneration should be proportioned to the services rendered or the risks run; and non-navigating members of the crew may therefore rank for only a small share or none at all. Generally speaking, an agreement whereby a seaman deprives himself of his right of salvage is not binding.

Salvage Department. The Salvage Department was formed for the purpose of collecting the waste material not only of the battlefields but also of battalions, &c., not in the line. In the official order notifying the formation of the Salvage Corps it was described as " an important Administrative Service ", and the performances of the department under a ' Controller of Salvage ' at general head-quarters show that its importance was thoroughly realized. After the Armistice the Salvage Department continued its work in France for many months, and there is still a Controller of Surplus Stores and Salvage in the department of the Quarter-Master General to the Forces at the War Office.

Salvation Army, a religious and philanthropic body which owes its existence to the late 'General' William Booth (q.v.) and his wife Catherine. The latter commenced preaching in the north of England about 1860; a few years later the Christian Mission was established, its object being to get in touch with that ' submerged tenth ' over which already existing religious bodies had little or no influence. General Booth instituted open-air and other meetings in London, and in 1878 reorganized the Mission on a military basis, with 75 local corps and 120 field officers in London and other towns. Two years later the now familiar name of the ' Salvation Army ' was adopted. At first the organization met with much opposition; but hostile criticism sank to silence when King Edward VII, in an interview with the late General Booth, warmly expressed his personal interest in the work; and, whatever differing opinions obtain regarding its religious creed and methods, there is little question of the value of its philanthropic and reforming work. Its creed is simple; the reality of Sin, the physical literalness of Eternal Punishment, and the need of Redemption are leading tenets. As to its organization, all officers, both male and female, wear a uniform; total abstinence is enforced on all regular members; while the use of tobacco in any form is a complete bar to promotion. Below the rank of ' General '—a position occupied since the founder's death (1912) by his son, Bramwell Booth—there are a Chief of the Staff, Foreign Secretary, Chancellor, &c. The General exercises what is practically autocratic power; but balance-sheets and other statements of the Army's financial affairs are issued to the public. Funds for the work are secured by collections at all meetings, and by voluntary contributions and bequests; while in 1921 the annual ' Self-Denial Week ' brought in over £160,000. The Salvation Army has established and conducts several farm colonies, of which the best known is at Hadleigh, Essex. It has workshops and factories, labour bureaux and homes, slum-posts, shelters for ex-criminals, soup-kitchens; maternity and industrial homes for women; schools, shelters and crèches for children; with many other admirable institutions of a like nature. The visiting of public-houses is another item of its work, as is the prison-gate branch; while police-court magistrates sometimes place first offenders in the hands of its officers as a preferable alternative to committing them to jail. In 1927 the Salvation Army controlled more than 14,000 corps and societies, 31,000 officers, cadets, and employees, with nearly 75,000 local officers. Its energies were displayed in 78 countries, and its officers spoke 46 languages. Among numerous publications, *The War Cry* is best known in Britain.

Salviniaceæ, one of the two families of the water-ferns or Hydropterideæ (q.v.), comprising the genera Salvinia and Azolla. They are small floating water-plants, found especially in the tropics. *Salvinia natans* has two rows of ordinary leaves which lie upon the surface of the water, and a third row of finely divided submerged leaves which closely resemble roots. Azolla has smaller leaves than Salvinia, and possesses true roots.

Salween, or **Salwen**, the second river of Burmah, ranking next to the Irawadi. Its springs are located in unexplored regions east of Tibet, and it flows generally in a north-and-south direction parallel to the Irawadi, falling into the Indian Ocean (Gulf of Martaban) below the wooded heights of Moulmein. Vessels of the largest size can reach Moulmein, the only town of any importance on the river. Vast quantities of teak are annually floated down stream and shipped at Moulmein. The area of the Salween basin is 62,700 sq. miles approximately; the river is about 800 miles in length, and from 1 to 4 miles in average breadth.

Salween, a hill district of Lower Burmah, in the extreme north of the Tenasserim division. Manufactures are undeveloped, but some oil is expressed from sesamum seeds, and there are some licensed distilleries providing for local consumption. There is some cotton-weaving, a cottage industry. Throughout the district the soil is poor; rice is the staple crop, areca palm grows in sheltered spots, and some betel-nuts and native cereals are raised. Area, 2666 sq. miles; pop. 46,000 (60 per cent Animists and 40 per cent Buddhists). Papun is the head-quarters.

Salzburg, a province of the Republic of Austria, belonging to the Eastern Alps. The people are mainly of German-speaking Roman Catholic peasant class, and are engaged in dairying and cattle-breeding. Salt, copper, iron, and marble are among mineral products, and there are numerous mineral-springs. Area, 2768 sq. miles; pop. 214,200. The capital is Salzburg.

Salzburg (sȧlts'bụr*h*), a city of Austria, capital of the province of Salzburg, on the Salzach, which is here hemmed in between two isolated hills. The principal buildings include the cathedral (1614–68), built in imitation of St. Peter's, Rome; the archbishop's palace, Government buildings, exchange, and museum. There is a theological seminary, a last remaining relic of the pristine splendour of Salzburg University, founded in 1623 and suppressed in 1810.

Salzburg was the seat of a bishopric founded by St. Rupert of Worms about A.D. 700, and in 798 it became an archbishopric. The Bishops of Salzburg were princes of the German Empire, and held the position of sovereigns over the archbishopric till it was secularized in 1802 (Peace of Lunéville) and given to the Archduke of Austria and Grand-Duke of Tuscany in exchange for Tuscany. Pop. (1920), 36,750.

The Tauern Railway ex Salzburg pierces the main Tauern range by a tunnel 5⅓ miles in length and 4000 feet in altitude, whence it enters the Moll Thal, runs down to Villach, south to Toplitz, and east to Rosenbach, where a line from Klagenfurt joins on; then south again to penetrate the Karawanken range, and to enter Carniola by the valley of the Save.

Salzkammergut (zȧlts′kȧm-ėr-göt), a district of Austria, between Salzburg and Styria. It is alpine throughout, is celebrated for its scenery, and contains the beautiful lakes of Traun and Hallstatt. The district raises great numbers of cattle, is well wooded, and is rich in minerals, especially salt, to which it owes its economic importance. Gmunden is the capital; other towns are Hallstatt, Ischl, Traun-Kirchen, and Ebensee. Pop. about 50,000.

Samar′, one of the Philippine Isles, separated by channels from Luzon on the north, and Leyte on the south. Area, 5130 sq. miles. The island is densely wooded and exceedingly productive. The chief products are rice, cocoa, palm-oil, hemp, and timber. Pop. (roughly), 250,000.

Samara, a former government in the Volga Basin (q.v.), South-Eastern Russia. It lies to the west of the Lower Volga, which flows for 550 miles along its western border, and has an area of 58,000 sq. miles. Before the Revolution the population was over 4,000,000. Agriculture, forestry, fishing, hunting, and live-stock raising occupied most of the inhabitants. Barley, rye, wheat, millet, flax and hemp, potatoes, buckwheat, hay, and tobacco comprise the principal crops. Large numbers of horses, cattle, sheep, pigs, and camels (bred as draught animals) are raised in normal times. Samara is especially a great horse-breeding region, and had over 1,000,000 head in pre-Revolutionary times. About 5 per cent of Samara is under timber, oak, elm, maple, lime, poplar, and aspen being prominent. There are large flour-mills, distilleries, breweries, and machine-manufacturing industries.

Samara, a town of Russia, capital of the former government of Samara, on the Volga, at the convergence of the Siberian and Central Asian Railways. In 1909 it was the sixth Volga port in tonnage, coming after Astrakhan, and before Kazan. It is a great centre of the oil-seed trade, and is important as a first-class river-port on the route between the Russian industrial districts and Siberia. Industries include flour-milling, iron-founding, soap-making, brick-making, and tanning. Pop. 150,000.

Samaria (modern **Sebustieh**), an ancient city of Palestine, for 200 years the capital of the Kingdom of Israel. It stood on a hill surrounded by higher hills. Samaria was built by Omri, King of Israel, about 920 B.C., and was the metropolis of the ten tribes till they were carried away into captivity about 720 B.C. After its destruction by John Hyrcanus (120 B.C.) it was rebuilt, and was renamed Sebaste (Augusta) in honour of Augustus, the name surviving in the modern name of Sebustieh. Sebaste was given by Augustus to Herod. The town is now capital of one of the seven districts of Palestine.

Samaritans, a small tribe of people now living in Nablus, the ancient Shechem, who represent the remnant of an ancient Jewish sect. The name is derived from Samaria, the capital of the Kingdom of Northern Israel. After its fall, the city of Samaria was repopulated with Assyrian colonists, with whom the people remaining in the territory, and consisting of the tribes of Ephraim and Manasseh, mingled freely. When the Jews on their return from captivity rebuilt the temple of Jerusalem, the Samaritans desired to aid in the work; but their offers were rejected by the Jews, who looked upon them as unclean, because they had intermingled with heathens. The Samaritans avenged themselves by hindering the building of the city and temple. About 332–331 B.C. the Samaritans emerged as an independent religious community, having built a temple on Mount Gerizim, near Nablus. At present the Samaritans number about 140 souls. The modern Samaritans support themselves by mechanical labour and money dealings. They avoid any connections with other sects, and marry only among their own people. For this reason they are doomed to disappear sooner or later.

Language and Literature.—The native tongue of the Samaritans was Hebrew, but under the influence of Aramaic and Arabic, Hebrew gradually took a second place in Palestine, as well as in Samaria, where some centuries before the Christian era Aramaic became the vernacular. The language of the Samaritans is a dialect of Aramaic, and is related to that spoken by the Jews of Galilee. The script employed by the Samaritans differs from the Hebrew square character, and represents an earlier type of the Phœnician character. Samaritan literature consists of: (1) The Samaritan *Pentateuch*, an ancient Hebrew version of the five books of Moses, dating from the fourth century. A manuscript copy of the Samaritan *Pentateuch* is in existence, and is said by the Samaritans to have been written in by Abishua, the great grandson of Aaron, but only dates from the twelfth century. (2) The Samaritan *Targum*, or Aramaic translation of the *Pentateuch.* (3) The Liturgy, and (4) The Chronicles (*Book of Joshua*, *The Chronicle of Abu'l-Fath*, *&c.*).—Cf. A. S. Rappoport, *La Liturgie Samaritaine.*

Samarkand′ (ancient Maracanda), a city of the autonomous Republic of Turkestan (federated with the R.S.F.S.R.), Central Asia, in the valley of the Zerafshan, 156 miles east of Bukhāra. It consists of the newer Russian quarters, the citadel, and the old native town. Samarkand was once the capital of a powerful Asiatic kingdom, and subsequently of Tamerlane's empire. It was ceded to Russia in 1868, when extensive irrigation works were constructed, and the Transcaspian Railway now serves the city. Pop. 100,000. Under the imperial régime Samarkand was capital of a province having an area of 26,630 sq. miles and a pop. of about 900,000.

Sambalpur, a district and town in the Orissa division of Bihar and Orissa, India. The district is traversed from north to south-east by the Mahanadi for a distance of 90 miles, and by the Ib, one of its affluents. Rice is the staple export. *Til* (sesamum), pulse, cotton, and sugarcane are also raised; the Rāmpur coal-field is within the district. The town is the headquarters of the district, and is the commercial centre for the states of Patnā, Sonpur, and Rairā Khol. Silk and cotton cloth is woven. Area, 3830 sq. miles; pop. (district), 750,000; (town), 13,000.

Sambar, or **Sambur**, the name of a group of deer native to South-East Asia. The antlers are three-pronged, and the brow-tine is set on to the beam at an acute angle. The largest, and type-species, is the Indian Sambar (*Cervus unicolor*).

Sambre (säṇ-br), a river of North-Eastern France and Belgium, a tributary of the Meuse, which it enters at Namur; length, 110 miles.

Samnites (-nītz), an ancient people of Lower Italy, who were of Sabine stock, and consisted of several tribes. Their first war with the Romans resulted in favour of the latter, and secured a Samnite alliance during the Latin War (340–338 B.C.). The second Samnite War (326–304 B.C.) was a fierce contest, in which the Romans were shamefully defeated at the Caudine Forks, but were finally successful. The third Samnite War (298–290 B.C.) saw the overthrow of the Samnites and Gauls at Sentinum. When the Italian allies of Rome revolted against her in 90 B.C., the Samnites once again rose against their oppressors, but were completely subdued and almost extirpated by Sulla.

Samo′a, an archipelago in the Pacific Ocean, divided between the United States and New Zealand. Nine main islands (including Savaii, Upolu, Apolima, and Manono) form the British territory of Western Samoa, in accordance with League of Nations mandate of 17th Dec., 1920. The people are Christian Polynesians. Copra is the chief product; sugar, rubber, cocoa, and cardamoms are also raised. A wireless station is located at Apia. Pop. 2026 whites (1050 being British, 400 Germans, 300 Americans, and some Swedes, &c.); Samoans, 33,000; coolie labourers, about 1000. American Samoa comprises Tutuila (44 sq. miles), Tau, and other islets in the Manua group (14 sq. miles), with a pop. (1920) of 8330 (266 being American whites). The harbour of Pagopago (Tutuila) is a United States naval station. Oranges, limes, grape-fruit, and copra are produced. Tutuila has a wireless station.

By an agreement of 1899–1900 Britain renounced her rights over Samoa, partly in favour of Germany and partly in favour of the United States. On 29th Aug., 1914, German Samoa was occupied by imperial troops.

Samos (now Samo), a Greek island in the Ægean Sea, near the coast of Asia Minor, 45 miles south-west of Smyrna; area, 180 sq. miles. It has a mountainous surface with several fertile valleys; produces corn, fruit, and excellent wine; and yields lead, iron, and marble. The principal town is Vathy, on the north-east coast. The chief exports are raisins, wine, oil, leather, and tobacco; imports, grain, colonial produce, and textiles.

Samos was inhabited in antiquity by Ionian Greeks, and had an important position among the Greek communities as early as the seventh century B.C. In the latter half of the sixth century it was in a specially flourishing condition under Polycrates, and subsequently was under the domination of Athens. In 84 B.C. it was united with the Roman province of Asia. In 1550 it was conquered by the Turks. From 1832 till 1912, when it was occupied by Greek troops, the island was a principality tributary to the Porte, under a Prince of Samos, who was a Greek Christian. Pop. 65,700.

Sam′othrace, or **Samothraki**, a Greek island in the north of the Ægean Sea. It has a very mountainous surface, culminating in 5400 feet altitude. Its chief products are corn and oil. The island is of interest as being in antiquity the chief seat of the worship of the Cabiri, and celebrated for its religious mysteries. Area, 30 sq. miles; pop. 3000.

Samoyeds, a division of the Turanian family (q.v.), numerically small, but occupying an enormous region of Northern Eurasia between the Arctic Ocean and the Altai-Sayan mountain ranges, and between the White Sea and the Khatanga River. Some of them, as, for example, those living in the Altai-Sayan region, have been almost completely Tatarized. Approximately 6000 Samoyedic people dwell on the European side of the Urals. Reindeer-breeding, fishing, and hunting are the staple industries, and some furs are traded. The Samoyedic language has a close affinity with the Finnic, the two in combination forming one of the two great divisions of the Turanian (Ural-Altaic) family of languages. There are three main and twelve sub-dialects in the branch. See *Turanian*; *Pan-Turanianism*; *Turkestan*; *Ural-Altaic*; *Turkey*; *Tungus*; and diagrammatic map under *Turanian*.

Samphire (*Crithmum maritimum*), an umbelliferous plant, very succulent, which grows wild along the sea-coast of Europe, and is used as a pickle.

Samson, an early Hebrew hero of the tribe of Dan, the son of Manoah, reckoned one of the judges of Israel. The well-known story of Samson is found in *Judges* (xiii, 2 to xvi, 31), and is the subject of Milton's drama *Samson Agonistes*, and of Saint-Saëns's opera *Samson and Delilah*.

Samsun, a Turkish seaport on the Black Sea, in the vilayet of Trebizond. It has an open roadstead, and carries on a large trade in tobacco (known as Samsun), cereals, flour, wool, and skins. It was bombarded by the Russian Black Sea fleet during the European War. Pop. about 15,000.

Samuel (Heb. *Shemuel*, 'asked from', or 'heard of God'), the first of the order of prophets and the last of the judges of Israel. He assumed the judgeship of Israel about twenty years after the death of Eli, and headed a successful expedition against the Philistines. His administration was distinguished by the restoration of the neglected worship of Jehovah.

Samuel, Books of, in the Old Testament, are two in number in the modern editions of the Hebrew text. In Hebrew MSS. the work is one, the division into two books being first introduced by Bomberg, in 1518, at Venice. The principal periods embraced in the record are: the restoration of the theocracy under Samuel (book i, chaps. i–xii, 1171–1095 B.C.); the history of Saul's reign, ending with his death (book i, chaps. xiii–xxxi, 1095–55 B.C.); and the history of David's reign (book ii, 1055–15 B.C.). As regards the authorship of these books, it is evident they could not have been written by Samuel, since his death is recorded in book i, chap. xxv.

Samurai, the name applied to the Japanese warriors during the feudal régime. Originally the term designated the soldiers guarding the Tennō's palace. The Samurai, distinguished by great courage and patriotism, had a certain and peculiar code of honour and morality. The feudal system, however, was abolished in 1871, and the name of Samurai was changed into that of *shizoka*, or gentry; but the officers of the Japanese army and navy, and also the gendarmerie, are mostly of Samurai descent.

Sana', a town of South-Western Arabia, capital of Yemen, 170 miles N.N.E. of Mocha, situated in a valley 7000 feet above the sea. The chief manufactures are articles in gold and silver, gunpowder, sword-blades, &c. The staple article of trade is coffee. Pop. 25,000.

San Antonio, a seaport of Chile, South America, 40 miles south of Valparaiso, and the only improved port on the Chilian coast between Valparaiso and Talcahuano; served by a branch of the State Railways from Santiago. The Chilian Government has invested over a million and a quarter pounds sterling in port improvements.

San Antonio, a city of Texas, United States, the county seat of Bexar county, on the San Antonio River. The city is a health-resort, but it is also important industrially, and holds an International Fair annually in October. Railway cars and flour are manufactured, and there is also a large trade in agricultural produce. Pop. 161,000.

San Bernardino, a city of California, United States, the county seat of San Bernardino county. There are construction and repair shops of the Santa Fé Railroad, and the city, known as the 'Gate of Southern California', stands in a rich citrus-, alfalfa-, and cereal-growing region of Southern California. Pop. 12,800.

San Cristo'bal, a city of Venezuela, capital of the state of Táchira. Coffee production is carried on in the contiguous districts. Pop. 21,400.

San Cristobal de las Casas, a town of Mexico, in the state of Chiapas, 450 miles E.S.E. of the city of Mexico. There are manufactures of earthenware and coarse textiles, but the chief occupation in the vicinity is cattle-raising. Pop. about 14,000.

Sanctuary, Right of, is the privilege attaching to certain places in virtue of which criminals taking refuge in them are protected from the ordinary operation of the law. By the Levitical law there were six cities of refuge for the involuntary manslayer. During the Middle Ages the custom of sanctuary was much abused, the privilege being often extended to wilful malefactors. In England, particularly down to the time of the Reformation, any person who had taken refuge in a sanctuary was secured from punishment—except when charged with treason or sacrilege—if within the space of forty days he gave signs of repentance, and subjected himself to banishment. Sanctuaries were finally abolished in 1697 by 8 and 9 Will. III, cap. xxvii.

Sand, George (Amandine-Lucie-Aurore Dupin, afterwards Madame Dudevant), French novelist, born 1804, died 1876. She was the daughter of Maurice Dupin, an officer of the Republican army, who was descended from a natural daughter of Marshal Saxe. Until the age of fourteen she was brought up at the Château de Nohant, near La Châtre (department of Indre), mostly under the care of her grandmother, afterwards spending nearly three years in an Augustinian convent in Paris. In 1822 she married Casimir Dudevant, to whom she bore a son and a daughter; but in 1831 separated from him, and took up her residence in Paris. In conjunction with Jules Sandeau, a young lawyer, she wrote *Rose et Blanche*, which was published in 1831, with the pseudonym Jules Sand. The reception it met with afforded her an opportunity of publishing a novel solely by herself—*Indiana*, under the name of George Sand, which she ever after retained. *Indiana* had a brilliant success, but excited much criticism by its extreme views on social questions. This was also the case with many others of her works. *Valentine*, *Lélia*, *Jacques*, *André*, *Leone Leoni*, *Simon*, *Mauprat*, *La Dernière Aldini*, *Lavinia*, *Metella*, and others appeared within the first few years after her début. She visited Italy with Alfred de Musset; and lived eight years with Frédéric-François Chopin, the composer. These relations also influenced or occasioned some of her works (as in the case of Musset *Elle et Lui*, 1858). In 1836 she obtained a judicial separation from her husband, with the care of her children. In 1854 she published *Histoire de ma vie*, a psychological autobiography. Among her other works are: *La Mare au diable*, *François le Champi*, *La Petite Fadette*, *Jean*, *Tévérino*, *La Filleule*, *Les Maîtres sonneurs*, *L'Homme de neige*, *Pierre qui Roule*, and *Monsieur Sylvestre*.

Sand, the grains of mineral matter formed by the disintegration of rock-masses. They consist usually of silica, as quartz is an abundant constituent of rocks, and is much harder and more durable than the other common minerals present. Many sands are coloured yellow, red, or brown by small amounts of iron hydroxide on the surface of the grains; others are coloured green by grains of glauconite. Valuable metallic ores, as those of gold, platinum, tin, thorium, and titanium, often occur mixed with sand. Pure siliceous sands are very valuable for the manufacture of glass, for making mortar, filters, moulds in founding, &c.

Sanda, a small island of Argyllshire, Scotland. It lies S.S.E. of the Mull of Kintyre, and is about 1½ miles long and ½ mile broad. There is a lighthouse on the island.

Sandal-wood (genus Santălum, nat. ord. Santalaceæ), a tree belonging to the East Indies and the Malayan and Polynesian islands, remarkable for its fragrance. Its wood is used as a perfume, and is manufactured into glove-boxes and other light articles. It is largely used as incense in the worship of Brahmans and Buddhists.

Sandarach (san′da-rak), a resin which exudes from the bark of the sandarach tree. It is used as incense, and for making a pale varnish.

Sandarach Tree (*Callitris quadrivalvis*), a large coniferous tree with straggling branches. It is a native of Morocco, Algeria, and Northern Africa generally. The timber is fragrant, hard, and durable.

Sanday, one of the Orkneys, an island of very irregular shape, generally with a very flat surface and a light sandy soil. There are a number of small lakes. Area, 26 sq. miles; pop. 1500.

Sandbach (sand′bach), an urban district and market town of Cheshire, England; served by the London & North-Western Railway. It has a grammar-school (founded 1594), and in the market-place are two antique obelisks. Boots and chemicals are made, and in the neighbourhood are salt-works. Pop. (1921), 5850.

Sand-blast, a process by means of which common sand, powdered quartz, or emery is driven with considerable force upon the surfaces of hard materials so as to clean, abrade, or engrave them. The blast is obtained by the use of a steam or air jet. The process is used in frosting the globes of electric lamps, in cleaning metal castings, in removing a thin facing from the stonework of old buildings, and in the cleaning and resharpening of files.

Sand-crab, or **Racing Crab**, a genus (Ocypŏda) of crabs, which live in holes in the sand along the sea-shores of warm countries, and are remarkable for the rapidity of their motions.

Sand-eel, a genus of teleostean fishes belonging to the sub-order Anacanthini. The body is slender and cylindrical, varying from 4 inches to about 1 foot in length, of a beautiful silvery lustre, destitute of ventral fins, with scales hardly perceptible. There are two British species, viz. *Ammody̆tes tobianus*, the lesser sand-eel or launce, and *A. alliciens* or *lanceolatus*, the greater sand-eel or launce. They are common on the British coasts, burying themselves in the sand to the depth of 6 or 7 inches, whence the smaller species is dug out by fishermen for bait. They are delicate food.

Sander (*Lucioperca sandra*), a species of fishes belonging to the perch family, and found in freshwater rivers and streams in the east of Europe. It attains an average length of from 3 to 4 feet. It is known under the name of pike-perch.

Sanderling (*Calidris ărenaria*), a bird of the plover family, averaging from 6 to 8 inches in length, which breeds in the Arctic regions, and in winter migrates southwards. It feeds on small marine animals, and chiefly inhabits the sandy tracts of the sea-beach.

Sand-flies, or **Buffalo-gnats** (genus Simulium), the name of certain flies found in various countries, the bite of which may give rise to painful swellings, and is sometimes fatal to cattle—as in the Danubian region. The larvæ and pupæ are aquatic.

Sandgate, an urban district and watering-place of England, in the county of Kent; served by the South-Eastern & Chatham Railway. To the north-west is Shorncliffe Camp. Pop. 2000.

Sand-grouse (Pterocles, Syrrhaptes, &c.), birds of the plover order (Charadriiformes) belonging to the family Pteroclidæ. They are natives chiefly of the warm parts of Asia and Africa, and are most abundant in arid sandy plains. The legs are longer than in other grouse, and the tail and wings are pointed. Pallas's sand-grouse differs from these in having feathered tarsi and united toes. It has been made the type of the genus Syrrhaptes, and is a native of the sandy plains of Central Asia, where it occurs in vast numbers.

Sand-hopper (*Talitrus locusta*), a species of small laterally flattened crustaceans of the order Amphipoda, common along most sea-shores.

Sand'hurst, a town of Berkshire, England, on the Blackwater. Sandhurst is famous for its Royal Military College, originally founded at Great Marlow in 1802, but removed to Sandhurst in 1812. Here cadets who have passed for the army are trained for a year and a half for commissions in the cavalry, infantry, R.A.S.C., and West Indian Service.

San Die'go, a city and port of entry of California, United States, the county seat of San Diego county, on the Pacific Ocean, between the Mexican border and Los Angeles. San Diego has a very equable and pleasant climate, and people live in tents upon the beach practically all the year round. Citrus fruit and grapes, &c., are raised. The harbour comes after San Francisco as the best in California; it has an area of 22 sq. miles, and is a coaling station of the United States navy. The growth of the city dates from the pushing through of the Santa Fé Railroad in 1884. Pop. 74,700.

Sand-lizard (*Lacerta agilis*), a lizard found on sandy heaths in Great Britain, and ranging through North and Central Europe to Central Siberia. It is about 7 inches long, generally sandy-brown on the upper parts, with darker blotches interspersed, and having black rounded spots with a yellow or white centre on the sides.

Sand-martin, or **Bank-martin** (*Hirundo* or *Cotile riparia*), the smallest British member of the swallow family, so named from its habit of nest-building in holes dug in the high banks of rivers, or in the sides of sand or gravel pits. The colour of the sand-martin is a soft brown on the head and upper parts, and white below, with a dark-brown band on the chest.

Sandoway, a maritime district and town in the Arakan division of Lower Burmah. Agriculture and fishing are the staple occupations, rice, sugar-cane, maize, tobacco, sesamum, and plantains being produced, and fishing carried on at two adjacent turtle banks. The town is the head-quarters of the district. It stands on the Sandoway River, and may be reached by vessels of light draught. Area (division), 3780 sq. miles; pop. 100,000; pop. (town), about 3000.

Sandown, an urban district and watering-place in the Isle of Wight, 5 miles south of Ryde, finely situated on a bay on the south-east coast. It has a fine beach, pier, promenade, and excellent bathing. Pop. 5700.

Sand-pipers, a group of small birds belonging to the plover family (Charadriidæ). These birds inhabit the sea-shore and banks of rivers, and grope in the soft mud for the worms, small molluscs, insects, &c., upon which they feed. They migrate southwards in winter. The summer plumage differs from the winter dress. The voice is shrill and unmusical; and they are fast runners and fliers. The common sand-piper or summer-snipe (*Totănus hypoleucus*) visits Britain in summer, and is of a greenish-brown hue mottled with black. The green sand-piper (*T. ochropus*), on the contrary, leaves Britain for the north in summer. The little sand-piper or little stint (*Tringa minuta*), an Indian and South African bird, is occasionally seen in Britain. The purple sand-piper (*Tringa maritima* or *striata*), a native of Greenland, Spitzbergen, &c., is also a summer visitant. The dunlin, knot, greenshank, and redshank are also known as sand-pipers.

Sandpipes, in geology, a name given to long, vertical, cylindrical hollows, tapering to a point, penetrating sometimes deeply into limestone, and filled with sand, gravel, or clay. They originate in the solution of the limestone by water percolating downwards, and by the consequent lowering of surface-deposits into the hollows thus produced.

Sandringham, a parish and village of England, in Norfolk, 7 miles N.N.E. of King's Lynn. Here is an estate formerly belonging to King Edward VII, for whom Sandringham House was erected, when Prince of Wales, in 1870. Pop. of parish, about 500.

Sand-star, or **Brittle-star** (Ophiura, Ophiocoma, &c.), star-fishes belonging to the order Ophiuroidea. In the sand-stars the arms or rays are mere locomotor appendages to the body.

The ambulacral system of vessels is not well developed, and does not subserve locomotion as in the Asteroidea.

Sandstones consist usually of grains of quartz cemented into a compact rock, which may also contain particles of felspar, minute scales of mica, and an admixture of clay, indicating in many places their immediate derivation from the débris of granitic rocks. The cement is in variable quantity, and may be calcareous or marly, argillaceous or argillo-ferruginous, or even siliceous. The grains of quartz are sometimes scarcely distinguishable by the naked eye, and sometimes are equal in size to a nut or an egg, as in the coarse types called siliceous conglomerates, or sometimes pudding-stone. The texture of some sandstones is very close, while in others it is very loose and porous. Some sandstones have a fissile structure, and form typical flagstones. In colour sandstone varies from grey to reddish-brown, in most cases uniform, but in others variegated. Some sandstones are ferruginous, having a cement or stainings of iron hydroxide. Sandstones are in general distinctly stratified, with cross-joints that cause them, when exposed on hillsides, to weather out as 'edges'. Their material was in most cases deposited near a shore, like the modern sand-beaches, and they often show irregular bedding due to current action. Sandstone in some of its varieties is very useful in the arts, and when it has no tendency to split is known by the name of *freestone*. When sufficiently solid, it is employed as a building stone.

Sandūr, a small native state, one of five in direct political relations with the Madras Government. It is an enclave of the district of Bellary, and has an area of 161 sq. miles. Native food grains are the chief crops; pulses, oil-seeds, betel, and tobacco are also produced. In minerals the state is rich, the hematite ore being the richest in India; manganese (48 per cent MnO_2) has also been found. Pop. 13,000.

Sandusky, a city and port of entry of Ohio, United States, the county seat of Erie county, on Sandusky Bay, an arm of Lake Erie. A large trade in lumber, stone, cement, coal, fish, ice, and fruit is maintained. Pop. 22,900.

Sand-wasp, a name of hymenopterous insects of the genus Ammophila, group Fossores or diggers. The sand-wasp inhabits sandy banks, and runs through the grass with great activity, continually vibrating its antennæ and wings. The female excavates a burrow for the reception of her eggs, and stocks it with caterpillars which she has paralysed by stinging.

Sandwich, a municipal borough and one of the Cinque Ports of England, in the county of Kent, on the Stour, 2 miles from the sea at Pegwell Bay; served by the South-Eastern & Chatham Railway. Made a Cinque port by Edward the Confessor, it was the royal naval port until the time of Richard II. It has an ancient guild-hall, three ancient parish churches, and a grammar-school. The place has a considerable trade, and carries on brewing, malting, tanning, &c. Pop. 3160.

Sandwich Islands (Hawaii), a North Pacific archipelago; area, 6450 sq. miles; pop. about 276,000. The largest islands are Hawaii (4015 sq. miles), Maui (728 sq. miles), Oahu (598 sq. miles), Kauai (547 sq. miles), Molokai (261 sq. miles), and Lanai (139 sq. miles). Honolulu (in Oahu) is the capital; pop. 83,400. The Hawaiians are Christians, mainly Anglican and Roman Catholic. English is the customary language in schools; primary education is free. Sugar and pineapples are the main staples; tobacco, coffee, honey, hides, rice, cotton, bananas, sisal, and wool are exported. Trade is mainly with the United States. In 1894 a republic was proclaimed, the islands being annexed to the United States in 1898.—Cf. W. R. Castle, *Hawaii, Past and Present.*

Sandwort (Arenaria), a genus of plants of the nat. ord. Caryophyllaceæ, comprising low herbs with usually awl-shaped leaves and small white flowers. Several species are found in Britain, chiefly on sandy shores.

Sandy Hook, a low sandy peninsula of New Jersey, United States, at the entrance to New York harbour, and enclosing New York Lower Bay. It has a fort.

San Fernando, a seaport-town and naval base of Andalusia, Southern Spain, in the province of Cadiz, on the rocky Isla de Leon, which lies among the salt marshes of the south shore of Cadiz Bay. Salt, the staple trade of the town, is made in the *salinas* and marshes between San Fernando and Cadiz. Until 1810 the town bore the same name as the island. Pop. 30,000.

San Francisco, a seaport-city of California, United States, the largest city in the state, and the metropolis of the Pacific slopes, on a peninsula which lies between the bay of San Francisco and the Pacific Ocean.

An exceptionally interesting feature of San Francisco is its foreign quarters. Nothing like Chinatown is in existence elsewhere. It was wiped out in 1906, and the inhabitants lived in Oakland until 1912, when the quarter (twelve city blocks) was restored with many improvements, but still retains a markedly Oriental character with its temples and variegated colours. There are also a Ghetto, a Latin quarter, and an Italian settlement.

The harbour or bay of San Francisco is the largest and most important on the Pacific slopes of the United States. The bay is about 49 miles in length, and has an area of 450 sq. miles, with a shore-line of 300 miles. There are several islands containing, the navy yard (Mare Island), the United States prison (Alcatraz Island), and the navy school (Goat Island). The entrance to the harbour lies through the Golden Gate, a strait about 1 mile wide and 5 miles long, which was once strongly fortified. Foreign trade is principally with Canada (British Columbia), China, Japan, Latin America, the Philippines, and the Hawaii group, but the coastal trade is paramount. Fruits and timber are important staples of commerce, and a large tonnage of wheat is included among exports.

San Francisco in 1847 had only a population of some 500. In 1848 gold was discovered, and a rush took place, which had raised the population in 1852 to 34,870. At various times the city suffered severely from fires, and—a far greater catastrophe than any of these—it was almost totally destroyed by earthquake on 18th April, 1906, and by fires thereby caused. Pop. (1920), 506,700.—Cf. J. S. Hitell, *A History of the City of San Francisco.*

Sangir Islands (sȧn′gēr), a group of fifty small islands in the Malay Archipelago, belonging to the Netherlands, and situated between the north-east extremity of Celebes and Mindanao (Philippines). Rice, bananas, and sago are cultivated, and the coco-nut palm is plentiful. The islands are all mountainous, partly volcanic, and coral fringed. Pop. 110,000.

Sangli, a native state of India, in Bombay, one of the Southern Maratha Jagirs. It is partly watered by the Kistna, and produces millet, rice, wheat, grain, and cotton. Coarse cotton cloth is manufactured. The chief town is Sangli. The state became a British feudatory in 1818. Area, 1120 sq. miles; pop. (state), 230,000 (mainly Hindus); (town), 16,000.

Sanguinaria. See *Blood-root.*

Sanguisorbeæ, or Sanguisorbaceæ, one of the sub-orders of the nat. ord. Rosaceæ, consisting of herbaceous or under-shrubby plants. It is distinguished by the constantly apetalous flowers, indurated calyx, and solitary, or almost solitary, carpels. See *Burnet.*

Sanhed′rin (corrupted from the Greek *synedrion*, a council), the supreme judicial tribunal of the Jews, existing in the time of the Maccabees and in New Testament times. According to the Talmud, it was founded by Moses when he elected seventy elders to assist him in judging the children of Israel in the wilderness, but this view is now generally rejected. The sanhedrin consisted of seventy members besides the president, who was usually the high-priest. The council became extinct in A.D. 425.

Sanicle (*Sanicula europea*), an umbelliferous plant, common in woods in Britain. It is one of the comparatively few Umbellifers with simple umbels. The fruits are ‘ burs ’.

San Joaquin (*hō*-ȧ-kēn′), a river of California which rises in the Sierra Nevada and traverses the valley of the same name from the Tulare Lakes, joins the Sacramento, and falls into Suisun Bay. It has a length of 350 miles, and is navigable for 50 miles to Stockton. The valley is a rich fruit-producing region.

San José (*hō*-sā′), a city of California, United States, the county seat of Santa Clara county, in the Santa Clara Valley. Wheat, wine, dried and canned fruits, tobacco, &c., are produced there, and there are railway repair shops. Pop. 40,000.

San José, capital of the Republic of Costa Rica, Central America, in the state of San José, of which it is also the capital. It stands on a tableland 4500 feet above the sea-level. There are fruit canneries handling the produce of the contiguous districts, and a large trade is carried on in coffee. San José is the largest city of Costa Rica. Pop. (1921), 39,000, or 51,500 with suburbs. The province of San José has a pop. of 141,300.

San Juan, a sub-montane province of Western Argentina, separated from Chile by the Andean Cordilleras. Cattle-raising and general agriculture are the principal pursuits; gold, silver, copper, iron, lead, and many other minerals exist. San Juan is the capital. Area of province, 37,865 sq. miles; pop. 85,000; (town), 17,000.

San Juan, a town of Porto Rico, the capital, chief port, naval station, and the largest town of the republic, on an island on the north coast. There is a fine harbour. Pop. 71,000.

San Luis, a province of Central Argentina. Grazing is the chief industry; agriculture is handicapped by the salinity of the water in the plains, and in some places by the entire lack of it. Irrigation is progressive. Area, 29,035 sq. miles; pop. (1921), 129,660.—San Luis is the capital (pop. 25,000); Mercedes is also important.

San Luis Potosí, a state of Mexico, in the Central Plateau. Minerals include gold, silver, lead, and copper; tropical fruits and cereals are raised. Area, 24,004 sq. miles; pop. 640,000.

The capital is San Luis Potosí (6200 feet altitude). There are railway workshops, cotton- and woollen-factories, and smelting-works. Pop. about 69,000.

San Marino, a small independent republic in Italy, of which it is an enclave. The territory consists of a hilly tract of some 38 sq. miles in area, with a frontier of 24 miles to the borders of the provinces of Forli and Pesaro e Urbino, near the Adriatic coast. It is the last surviving representative of the Italian republics, and claims to be the oldest state in Europe. At the head of the Government are two ‘ captains regent ’ elected for six months. There is a militia of 39 officers and 950 men. A treaty of friendship with the

Kingdom of Italy, concluded in 1907, was revived in 1920, and again in 1921. There is a republican coinage system in bronze and silver, and postage stamps are issued. The coinage is legal tender in Italy. Wine, cattle, and stone are exported. Pop. 12,030. The walled city of San Marino occupies the crest of a spur of the Apennines known as Monte Titano (2650 feet altitude), and is accessible only by the road from Rimini. The principal inhabitants, however, reside in the hamlet of Il Borgo, at its foot. Pop. of the town, about 1200.

San Miguel (mi-gel′), a maritime department of Salvador, Central America, on the Pacific, drained by the San Miguel River. It is an important gold- and silver-mining region. The capital is San Miguel, on the river of that name. Indigo, grain, rubber, and cattle are traded. The port is La Union. Pop. (town), 30,400.

Sannaza′ro, Jacopo, Italian poet, born 1458, died 1530. Sannazaro wrote sonnets and *canzoni* and an idyl (*Arcadia*) in Italian, as well as Latin elegies, eclogues, and epigrams.

Sanquhar (sang′kėr), a royal burgh of Dumfriesshire, Scotland, on the Nith; served by the Glasgow & South-Western Railway. Iron goods and textiles are manufactured; there is a coalfield in the vicinity; cattle and sheep fairs and an annual agricultural show are held. Pop. 1700.

San Remo, a city of Liguria, North Italy, in the province of Porto-Maurizio, on the Gulf of Genoa and the Riviera di Ponente. It is noted as a health-resort. Pop. 17,000.

San Salvador, a city of Central America, capital of the Republic of Salvador, situated near the volcano of the same name. The city has important manufactures of soap, candles, silk, cigars, and liquor. Earthquakes occurred here in 1854, 1873, and 1917, causing considerable damage. Pop. 81,000.

San Sebastian, a seaport-city and watering-place of Northern Spain, capital of the province of Guipúzcoa, on the Bay of Biscay. It was once strongly fortified, its fortifications including the castle of Mota on the summit of the sandstone mass of Monte Urgull, 493 feet high. The manufactures are somewhat varied, but San Sebastian is now famous as the most fashionable of Spanish seaside-resorts, and is one of the most beautifully situated watering-places in Europe. Pop. 52,000.

San Seve′ro, a city of Apulia, South Italy, in the province of Foggia, at the foot of Monte Gargano. Pop. 30,000.

Sanskrit (Skt. *saṃskṛita*, literally ‘ that which is duly prepared ’, as, e.g., food made ready for eating, or objects prepared for use by arts or crafts), signifies the ancient classical language of Aryan India, which arose as the vehicle of early Brahmanic literature. As its name denotes, it was the ‘ refined ’ speech moulded and used by the Brahmanic schools, as opposed to the Prakrit (*prākṛita*, ‘ primitive ’, from *prakṛiti*, ‘ primitive nature ’) or vernacular dialects derived from the same or cognate sources (see *Prakrit*). The language of the Ṛig-vēda (see *Vedas*) is not Sanskrit, though often included under that name; it is a dialect of very archaic type, with a few words and forms of early Prakrit, and, according to Sir G. A. Grierson (*Imp. Gazetteer of India*, 1907, vol. i, p. 357; *Bull. School of Or. Studies*, vol. i. pt. iii, p. 56 f.), was the ancient speech of the Eastern Punjab and Upper Ganges-Jamna Doab. The Brāhmaṇas, or Brahmanic expositions of the Vedas and their liturgies, are in a language of later type, which perhaps arose in the same region, and which, by constant polish in the schools of Brahman theologians, philosophers, and grammarians, developed into classical ‘ Sanskrit ’. True to its origin, Sanskrit has been mainly used for Brahmanic literature, though writers of unorthodox Churches—chiefly Buddhists and Jains—have also employed it.

Besides the refined Sanskrit of the schools, there existed from early times popular and imperfectly polished dialects standing to the former in the same relation as the dialects of Low Latin to the latinity of Cicero and Tacitus. Many scriptural and doctrinal works of Northern Buddhism have been composed in dialects of this kind. The study of the Vedic language by the Brahmans led them to create a really scientific system of phonetics and grammar, and thence to fix the standard of Sanskrit. A few early works on Vedic philology have survived, such as Yāska’s *Nirukta* (an exposition of the *Nighaṇṭus*, ancient lists of Vedic words), the *Prātiśākhyas* of the Vēdas, &c. Of writers on classical Sanskrit grammar the coryphæus is Pāṇini (date probably fifth century B.C., and almost certainly later than Yāska), in whose grammar the Vedic language is relegated to a secondary position. His *Ashṭādhyāyī*, in eight books of four chapters each, contains about 3983 aphorisms expressed in artificial form for the sake of brevity, monosyllables being invented to denote classes of words and their elements. It speedily superseded its predecessors, and has been the basis of nearly all subsequent grammars. Kātyāyana added to it a *vārttika*, notes showing points in which it seemed to him to be incomplete or inexact; and Patañjali (about 150 B.C.), in his *Mahābhāshya*, expounded Pāṇini and defended him against Kātyāyana’s criticisms. For further history of grammar, cf. S. K. Belvalkar, *Account of . . . Systems of Sanskrit Grammar*.

Sanskrit literature was first introduced to European students by Sir William Jones’s edition (1792) of the *Ṛitu-saṃhāra*, a poem ascribed to Kālidāsa, following on Sir C. Wilkins’s translation of the *Bhagavad-gītā* (1785) and

Hitōpadēśa (1787). The first European grammar was the *Sidharubam* of Paulinus à Sto. Bartholomæo (Johann Philipp Wesdin), at Rome (1790). European philologists, following the penetrating suggestions of Jones in his address to the Asiatic Society of Bengal (1786), soon proved that Vedic and Sanskrit are so closely akin to the ancient languages of Persia (Avestan, also called Zend and Old-Bactrian, and Old-Persian or Western Iranian) that they must all descend from a common ancestor, or at least from a group of nearly allied dialects, and that this original Indo-Iranian tongue was closely related to the language-groups—Balto-Slavonic, Hellenic, Italic, Germanic, Keltic, &c.—from which are derived, with insignificant exceptions, all the modern tongues of Europe. This Indo-Iranian speech was nearest to the Balto-Slavonic group, sharing with it, e.g., the change of unvoiced palatal *k* to a sibilant; in India, however, it borrowed considerably from the vocabularies of conquered native races, and in some important respects, notably the use of the gerund (absolutive), assimilated its idiom to the Dravidian. There is a rich Sanskrit literature, which is still growing. For many centuries the Brahmans were the chief representatives of intellectual interests, and they expressed themselves in Sanskrit. They taught religion, practical and speculative, at first that of the various Vedic schools (*Vēdas* and *Brāhmaṇas*, &c.), and then that of the Churches of Vishṇu, Śiva, and other deities which gradually supplanted the former. Their theology and philosophy (the latter deriving mainly from the former) were first conveyed in the earlier *Upanishads* and cognate works, which on the whole represent a movement towards monistic idealism (*Advaita*). To these, in course of time, were added other systems, viz. the dualistic *Sāṅkhya*, ascribed to Kapila, which opposes an infinite number of individual souls (*purusha*) to a single inanimate Nature (*prakṛiti*); the *Vaiśēshika* and *Nyāya*, attributed to Kaṇāda and Gōtama respectively, which are realistic and logical in method; the *Viśishṭādvaita*, or qualified monism of Rāmānuja, and various other schools, chiefly attached to the worship of Vishṇu or Śiva. (See *Hindu Law*.)

In course of time the Brahmans' primacy in religion and philosophy began to be challenged by sectarian schools, the most important being those of Mahāvīra-Vardhamāna, the founder of Jainism (died about 500 B.C.), and Gautama Śākya, called Buddha, who established Buddhism (died about 483 B.C.), both of whom were of the Kshatriya or warrior caste. The Jain scriptures (*Aṅgas*) were composed in Prakrit, i.e. vernacular; Buddha and his apostles usually preached in any tongue that was convenient, the Canon of Ceylon being preserved in Pali (see *Prakrit*), while in the north scriptures were more often written in Sanskrit of a more or less popular type, but sometimes also in Prakrit. Owing to the adoption of Buddhism by the Mauryan emperor Asōka (middle of third century B.C.), the supremacy of the Brahmans and their Sanskrit literature was for a time seriously threatened. But the danger soon passed away, and their power and influence steadily increased, until it reached its zenith under the Gupta dynasty (from A.D. 320). This was the Golden Age of Sanskrit. Poetry particularly flourished; already it had long been growing. The *Mahābhārata* (q.v.), originally a series of Kshatriya lays or ballads on the war of the Kauravas and Pāṇḍavas, and later expanded to its present colossal bulk by insertion of new episodes and religious or moral sermons by Brahman diaskeuasts, must have existed in some form about the fifth century B.C.; the *Rāmāyaṇa* (q.v.) or epic on the adventures of the hero and god Rāma, ascribed to the Brahman Vālmīki (who probably composed most of books 2–6), may be approximately of like age, and already shows in germ most of the features of the *Kāvya* or elegant poem, which are still further developed in the *Buddha-charita*, or life of Buddha, by the Buddhist Aśvaghōsha (first century A.D.?). Under the Guptas the *Kāvya* style reached perfection. Its greatest master was Kālidāsa, author of the poems *Raghu-vaṃśa*, *Kumāra-sambhava*, and *Mēgha-dūta*, and the dramas *Abhijñāna-śakuntala*, *Vikramōrvaśīya*, and *Mālavikāgnimitra* (probably early fifth century A.D.). Of other classical poems the most famous are *Kirātārjunīya* of Bhāravi (sixth century A.D.?) and *Śiśupāla-vadha* of Māgha (ninth century?); the other chief dramas are *Ratnāvalī* and *Nāgānanda*, ascribed to King Harshavardhana (died 647–648), the *Mṛichchhakaṭika* of Śūdraka, Bhavabhūti's *Mālatī-mādhava*, *Mahāvīra-charita*, and *Uttara-rāma-charita*, and Viśākhadatta's *Mudrā-rākshasa*. These masters have furnished models for a vast number of poems and dramas by Brahmanic and Jain poets, which is still increasing. Thirteen apparently ancient plays recently published at Trivandrum are ascribed by the editor to Bhāsa, a predecessor of Kālidāsa, but without adequate evidence.

The Hindus have also many works on the art of poetry (*alaṃkāra*) and dramaturgy. This literature, beginning with more or less pragmatic statements of poetical practice, soon developed into systems based upon æsthetic and dramaturgic theories of great subtlety. The chief works are Bhāmaha's *Alaṃkāra*, Daṇḍin's *Kāvyādarśa* (sixth century?), Vāmana's *Kāvyālaṃkāra-sūtra* with commentary (eighth century?), Ānandavardhana's *Dhvanyāloka* (ninth century), Mammaṭa's *Kāvya-prakāśa* (twelfth century?), Ruyyaka's *Alaṃkāra-sarvasva*, &c. Romances in prose, verse, and mixed style (*champū*) are fairly numerous; the finest is Bāṇa's *Kādambarī* (seventh century). Of more popular style are Sōmadēva's *Kathā-sarit-sāgara*, a huge collection of tales in fluent verse (about 1070); the *Vētāla-pañchaviṃśati*; *Siṃhāsana-dvātriṃśat*; *Śuka-saptati*; &c. Two anonymous fable-books, the *Pañcha-tantra* and *Hitōpadēśa* (q.v.), based upon the former, are noteworthy; the *Pañcha-tantra*, translated in the sixth century into Pahlavi, has thence travelled in various disguises through Asia and Europe.

Sanskrit is singularly deficient in regular history. At some early date B.C. an attempt was made to collect in simple verse the genealogies and histories of the dynasties of Northern India, and these, with additions reaching down to the fourth century A.D., form the basis of the older *Purāṇas*; but as the latter have been expanded by Brahmanic redactors into manuals of religious instruction, this historical nucleus in them has been interpolated and obscured, and it is only recently that attempts have been made (notably in F. E. Pargiter's *Ancient Indian Historical Tradition*) to estimate its real value. For later times, the only serious work is Kalhaṇa's *Rāja-taraṅgiṇī* (A.D. 1148–9), a history of Kashmir, which is far from accurate as regards events preceding Kalhaṇa's own times. There are, however, a number of panegyrical biographies of kings, in prose and verse, such as Bāṇa's *Harsha-charita* (life of Harshavardhana, who died A.D. 647–648), Bilhaṇa's *Vikramāṅka-dēva-charita* (life of the Chālukya Vikramāditya VI, who reigned 1076–1126), Padmagupta's *Navasāhasāṅka-charita* (life of Sindhurāja of Malwa, about 1010), Hēmachandra's *Kumārapāla-charita* (life of the Chaulukya Kumārapāla, reigned 1143–69), &c. Still more valuable are the numerous historical inscriptions and charters, many of which are of high literary merit. These, together with similar records in the old Prakrits and the Dravidian languages, have thrown much light upon Indian history from the fourth century B.C. onwards, which but for them would have been profoundly obscure.

Of medical works the best are the oldest, viz. those of Charaka (first century A.D.?), Suśruta, Vāgbhaṭa, Mādhava, &c. Later authors, though they have written copiously, have added little of real value. Most of the astronomical and astrological works, which are abundant, are based upon a system derived from the Greeks about the fourth century A.D. Those of the previous periods are of even less scientific value. As regards mathematics, it seems probable that our 'Arabic' numeration is of Indian origin, and Sanskrit literature shows that Hindi mathematicians attained considerable proficiency; how much of their science was original is uncertain.—BIBLIOGRAPHY: A. A. Macdonell, *History of Sanskrit Literature*; *A Vedic Grammar for Students*; *Vedic Grammar* (in Bühler's *Grundriss*); Max Müller, *History of Ancient Sanskrit Literature*; M. Winternitz, *Geschichte der indischen Litteratur*.

Santa Ana, a town of Salvador, Central America, capital of the department of Santa Ana. It is the second town of the Republic, and lies in the centre of a prolific coffee-raising and general agricultural region. Zinc, copper, silver, and iron are also found in the vicinity. Pop. 60,700.

Santa Anna, Antonio Lopez de, Mexican soldier, born 1798, died 1876. He took a prominent part in the expulsion of the Spaniards from Mexico, and proclaimed the Mexican Republic in 1822. His political life was one of many vicissitudes, and he was frequently in exile. He was President of the Mexican Republic in 1833, in 1846, and from 1853 to 1855.

Santa Barbara, a city of Southern California, United States, the county seat of Santa Barbara county, on the Pacific coast. Santa Barbara is a popular seaside- and health-resort, and the county oil-fields are noted. Pop. 17,000.

Santa Cathari′na, a maritime state of Southern Brazil; area, 20,785 sq. miles. Sugar, coffee, rice, maize, cassava, and wheat are the chief cultivated products. Yerba maté (*Ilex paraguayensis*) is exported, and some coal is worked in the fields of the Rio Tubarão, but is of inferior quality to that between the Rio Grande and São Paulo. Agriculture and cattle-rearing are the chief industries. There are a number of German settlements. The capital is Florianopolis (Desterro); other towns are Blumenau, Sages, Joinville, São José, and São Francisco. State pop. 635,000.

Santa Cruz, the southernmost territory of Argentina, extending north to south between Chubut and Tierra del Fuego, the eastern portion of which it shares with Chile, and bounded east and west by the Atlantic and the Andes respectively. Dry and cool climatically, the territory is mainly devoted to sheep-raising, and wild horses are abundant. Coal has been discovered. Gallegos, in the south-east, is the capital. Area, 109,142 sq. miles; pop. 11,600.

Santa Cruz, the easternmost department of Bolivia. It consists of open and grassy plains (about 900 feet altitude), which occupy the country between the slopes of the Andes and the Brazilian frontier, and are used for grazing, although the climate being hot and malarial, and the rainfall excessive, the principal Bolivian settlements are on the more agreeable Andean slopes. Owing to their flatness there is little or no drainage, and large areas are flooded in the wet season; there are many swamps. Sugar, rum, cacao, coffee, and rubber are produced, and some cattle are raised on the plains. Santa Cruz de la Sierra (pop. 25,800) is the capital. It stands on the Piray (a tributary of the Mamoré) at an altitude of 1400 feet, and is the metropolis of a sugar- and cattle-raising region, with flour-mills, sugar-refineries, distilleries, and tanneries. Porto Suarez, on the Paraguay, is a river-port. Both towns have wireless stations. Area, 144,941 sq. miles; pop. 338,220.

Santa Cruz, a city of California, United States, the county seat of Santa Cruz county, on the Bay of Monterey; served by the Southern Pacific Railway. It stands at the base of redwood-forested mountains, and is an important Californian health-resort. Near by there is a large piscicultural station. Santa Cruz was settled in 1797 as the Spanish pueblo of Branciforte, fell to the United States in 1846, and became a city in 1876. Pop. 11,000.

Santa Cruz, the seaport-capital of the Canary Islands and of the Island of Teneriffe, on which it stands. It is an important coaling station, and is the seat of the administration of the Canaries, of Teneriffe, and of the military governor of the island. Brandy and wine, cochineal, bananas, sugar, silk, &c., are exported. Water is supplied by means of an aqueduct (5 miles), and dromedary-transport is general. Pop. 63,650.

Santa Elena, a town of Ecuador, in the province of Guayas, and on the Gulf of Guayaquil. It is situated in one of the two Ecuadorean oil regions (the other is at Salinas), and the fields are in process of exploitation by several British syndicates, although it has yet to be proved that oil exists in commercial quantities. The climate of Santa Elena is agreeable and healthy.

Another Santa Elena is in Argentina, in the province of Entre Rios, and on the Paraná River. It has manufactures of meat products, and trades in hides and horns, &c.

Santa Fé, a province of Central Argentina, an alluvial plain which is fortunate enough to possess a 465-mile stretch of the Paraná River, but is subject to inundation, when the rich agricultural lands are completely covered. Wheat, corn, linseed, and alfalfa; dairying; meat curing and lard refining; and the raising of cattle, horses, sheep, and pigs are the chief occupations. The capital is Santa Fé, but Rosario is the largest city, and is second city of the Republic. Other towns are Colastiné, Coronda, Puerto Gomez, Reconquista, Villa Constitución, and San Lorenzo, which are all river-ports; and Ocampo, Rafaela, Villa Casilda, and Cañada de Gomez. The railway system is highly developed. Area, 50,713 sq. miles; pop. 1,007,500.

Santa Fé, a city of New Mexico, United States, the state capital and the county seat of Santa Fé county. Agriculture and mining (mainly coal) are extensively prosecuted in the adjacent country; in the city blankets and jewellery are made. Santa Fé became a city and the state capital in 1851. The railway was pushed through in 1880. Pop. 7250.

Santa Fé, a city of Argentina, South America, capital of the province of Santa Fé, on the Rio Salado; served by rail to Tucuman, Rosario, and Cordoba. Santa Fé is a port for small river steamers, but the port proper is at Colastiné, 7 miles distant, but connected by rail; Santa Fé has also direct ferry communication with Paraná. The city was founded in 1573. Pop. 60,000.

Santala′ceæ, a natural order of apetalous dicotyledons. In the form of weeds the genera are found in Europe and North America; in Australia, the East Indies, and the South Sea Islands they exist as large shrubs or small trees. Santălum, sandal-wood, is the chief genus.

Santal′ Parganas, The, a district in the Bhagalpur division of Bihar and Orissa. The Ganges, which bounds the district on the north and partly on the east, forms also its chief drainage. There are several small coal-fields, and copper, silver, and tin are found. Fifty per cent of the land is *bāri* or highland, and is practically uncultivable; the rest is covered with rice-fields. Madhupur, Deogarh, Sáhibganj, and Dumka (the district head-quarters) are the principal places. Area, 5500 sq. miles; pop. 1,900,000.

The district is named from the Santáli, who form the most characteristic portion of its inhabitants, and are numerous in the eastern section of the Chota-Nagpur Plateau and in Midnapore. They are one of the aboriginal races belonging to the Dravidian stock, are dark-coloured, and mostly profess a religion in which the worship of a chief deity and subordinate deities and a sort of ancestor worship play a chief part.

Santal-wood, a dye-wood obtained from *Pterocarpus santalīnus*, a leguminous tree of the East Indies, Madagascar, &c.; also called sanders or saunders wood and red sandal-wood. *Santalin*, a substance obtained from it, is used in dyeing blue and brown. Compare *Sandal-wood.*

Santander′, a maritime province of Northern Spain, traversed by the Cantabrian Mountains, and drained in the south by the Upper Ebro, and in the north by the short and rapid streams (Ason, Pas, Besaya, &c.) which flow to the Bay of Biscay. Large quantities of maize and other cereals and fruits are produced. Lead, iron, coal, and other minerals, including marble and stone, are worked. Area, 2108 sq. miles; pop. 323,641.

Santander, a seaport-city of Northern Spain, capital of the province of Santander, on the Bay of Biscay. It is a fashionable watering-place, the climate being mild but damp. There are local lead-, coal-, and iron-mines, and quarries of limestone and marble. Pop. 69,100.

Santander Norte, a department of North-Eastern Colombia, South America. Gold, silver, gems, cereals, rice, coffee, cocoa, and sugar are produced. Cúcuta (pop. 29,000), near the Zulia River and on the Venezuelan frontier, is the capital. It is a great coffee centre, and is served by rail to Puerto Villamizar. Area (department), 6255 sq. miles; pop. 239,250.

Santander Sur, a department of North-Eastern Colombia, South America, producing gold, silver, emeralds, tobacco, coffee, cocoa, and wheat. The capital is Bucaramanga (altitude, 3248 feet; pop. 25,000), a great coffee centre, on the Debrija River, and on the road from Bogotá to Maracaibo. Area (department), 17,865 sq. miles; pop. 440,000.

Santarem, a district of Portugal, in the province of Estremadura, watered by the Tagus and its affluents. Santarem and Thomar are the chief towns. Area, 2555 sq. miles; pop. 330,000.

Santarem, a city of Portugal, capital of the district of Santarem, in the province of Estremadura, on the Tagus; served by railway from Lisbon. It has interesting churches and an important Jesuit seminary. Pop. 10,000.

Santia'go, a province of Chile, mountainous and badly watered, but noted for its fertility and mildness of climate. Cattle-raising is important; some cereals are grown. Area, 5893 sq. miles; pop. 685,400.

Santiago, a city of Chile, capital of the Republic and of the province of Santiago, intersected by the Mapocho, a tributary of the Maipo. Owing to the prevalence of earthquakes the houses are mostly of one story, and generally occupy a large space of ground, having gardens and patios or courts in the interior. The Plaza de la Independencia is a large open area; around it are the municipal buildings, post office, archbishop's palace, and cathedral. Pop. (1920), 508,000.

Santiago-de-Compostella, a city of Spain, in the province of Coruña, on the Sar; served by railway from Tuy. The chief edifice is the cathedral, a Romanesque building founded in 1078, having in one of the chapels the image of St. James (Santiago) of Compostella (more correctly Compostela), which long attracted numerous pilgrims. Pop. 25,000.

Santiago-de-Cuba, a seaport-city of Cuba, province of Oriente; the chief city of the Republic, after Havana; served by rail to the capital (540 miles), by short sub-montane lines, and by steamships coastwise and to New York and Europe. It is the oldest town in the island, having been founded in 1514, is the see of an archbishop, has a fine cathedral, and a harbour rather difficult of access. Its trade is considerable. Pop. 70,250.

Santiago del Estero, a north-central province of Argentina. It is a low-lying, open plain, with large saline areas culminating in the swamps (Salinas Grandes) on the borders of Cordoba. The climate is hot, varying between 110° and 32° F., with a mean of 71° F., and the annual rainfall is about 25 inches. Sugar, cereals, tobacco, hides, and some cotton are produced. The capital is Santiago del Estero. Area, 55,885 sq. miles; pop. 298,200.

Santiago del Estero, a city of Argentina, capital of the province of Santiago del Estero, on the Rio Dulce. The name is derived from the large *esteres* (swamps) in the vicinity, and the Rio Dulce (or Saladillo) becomes lost in one of these, viz. the Salinas Grandes. Santiago del Estero is the oldest city of Argentina; it was founded in 1553, and was first capital of the province of Tucuman. Pop. 23,500.

San'tipur, a town in Nadiyá district, Bengal, on the River Hugli. It is well known for its cloth manufactures, has an annual fair which lasts for three days, and a considerable local trade. Pop. 30,000.

Santley, Sir Charles, British singer, born at Liverpool in 1834, died 1922. He appeared for the first time in 1857, and achieved a great success at the Handel Festival in the Crystal Palace in 1862. He appeared in oratorio, concert, and opera as a baritone of great compass, power, and finish. He was knighted in 1907.

Santo Domingo (*República Dominicana*), sometimes known as the **Dominican Republic**, a republic of the West Indies, occupying the eastern and larger portion of the Island of Haiti. It has an estimated area of 19,330 sq. miles, a coast-line of over 1000 miles, and 193 miles of frontier to the Republic of Haiti. The population (1921, 897,300) is divided among the provinces as follows:

Province.	Pop.
Santo Domingo	146,400
San Pedro de Macorís	43,600
Seibo	58,400
Azua	100,500
Barahona	48,100
Samana	17,000
La Vega	105,800
Pacificador	77,600
Espaillat	50,900
Santiago de los Caballeros	123,000
Puerto-Plata	59,000
Monte-Christi	67,000
Total—Santo Domingo[1]	897,300

Towns.—The city of Santo Domingo (pop. 1921, 30,957) is the capital; Puerto-Plata (7807), its port, is the chief tobacco and coffee port; Sánchez (3075) is the chief cacao port; San P.

---

[1] The figures are approximations based on the 1921 census returns.

de Macorís (18,802) leads in sugar; La Vega (6564) is one of the most beautiful of Dominican cities; others are San Francisco de Macorís (5188), Moca (3994), Azua (4707), Monte-Christi (2580), and Samana (1656). La Romana, a new port, was opened in 1912.

Production: Minerals.—These are abundant, including gold, silver, platinum, copper, iron (magnetite), manganese, nickel, petroleum (near Azua), lignite and anthracite coal, rock-salt, tin, lead, and precious stones. *Agriculture.*—Santo Domingo possesses one of the most suitable sugar-growing areas in the world, and sugar shipments always represent more than 50 per cent of the total exports. Other major staples are cacao, tobacco, and coffee. *Forestry.*—The mountainous regions of the Republic provide hardwoods, dye-woods, and building timber; lignum-vitæ, yellow-wood, logwood, cedar, mahogany, and spearwood growing in quantities of commercial value; some dividivi and resins are also exported.

Communications.—Roads are inefficient and in many cases non-existent, but are being rapidly improved. There is a railway system of (1919) 153 miles. *Weights and Measures.*—The metric system is the legal basis; old Spanish units and British units (for imported oil, flour, &c.) are in use. *Currency.*—The United States gold dollar is the standard, and United States currency is the legal medium of exchange.

Language.—Spanish prevails, but English is spoken and understood by the educated classes. *Religion, &c.*—Roman Catholicism is the State religion, but all other forms are tolerated. Primary education is free and compulsory.

Government.—The Constitution is dated 18th Nov., 1844, but has been amended and reproclaimed, the last reproclamation being in 1908. Legislative power is vested in a National Congress, comprising a Senate (12 members, 1 elected for six years from each province, and one-third of the Senators retiring biennially), and a Chamber of Deputies (24 members, 2 from each province, elected for four years, one-half retiring biennially). The President is chosen by an electoral college, and holds office for six years.—Cf. O. Schönrich, *Santo Domingo.*

Santo Domin'go, capital of the Republic of Santo Domingo (or Dominican Republic), in the Island of Haiti. It lies on the south-east coast at the mouth of the Ozama, and has a roadstead. After Isabela, it is the oldest European city in the New World, having been founded in 1496 by Bartholomew Columbus. Pop. (1921), 45,000.

San'tonin is a crystalline substance obtained from the unexpanded flower-heads of *Artemisia maritima* (see *Artemisia*). It forms colourless flat crystals, easily dissolved in alcohol, various oils, and chloroform, and is used solely to get rid of the round-worm (*Ascaris lumbricoides*) from the intestine. It has no action against other intestinal parasites.

San'torin (ancient Thera), a volcanic island, the largest of a small group in the Grecian Archipelago, 60 miles north of Crete. It extends as a crescent around a bay which is partially closed by the Island of Therasia and its southern continuation, the Island of Aspronisi. Aspronisi lies in the middle of the fairway between Therasia and the southern horn of the main island, the northern horn being separated by another channel from the island. The three Kaimenis, Old, New, and Little, occupy the centre of the bay, and these are the centre of volcanic activity. The shores of the inner curve are precipitous, but they slope gradually down to those of the outer curve, which are covered with vineyards. The famous Santorin wine is the staple of the island. All the islands are of volcanic origin; the last eruption took place in 1866. Pop. about 20,000.

Santos, a city of Brazil and one of the chief ports of entry of the Republic, in the state of São Paulo (q.v.); served by the British-owned São Paulo Railway. It is a great immigrant port and the world's greatest coffee-exporting centre. Fruit, rum, sugar, hides, tobacco, &c., are also traded. Pop. 90,000.

São-Francisco, a river of Brazil, which rises in the south of Minas-Geraes, flows N.N.E. through that state and the state of Bahia, forms the boundary between Bahia and Pernambuco, and afterwards separates Alagoas from Sergipe. It has a fall of 2700 feet in a length of 1800 miles. The principal obstruction to navigation is formed by the Paulo Affonso Falls.

Saône (ancient Arar), a river of Eastern France, rises in the Vosges, enters the department of Haute-Saône, then flows through the department of Côte-d'Or, continues south-west and receives the Doubs as tributary, reaches Châlon, where it flows due south until it joins the Rhone at Lyons; length, 301 miles; drainage area, 11,400 sq. miles.

Saône, Haute-, ('Upper Saône'), a department of Eastern France; area, 2074 sq. miles. It is drained by the Saône, the Ognon, &c., and there are many small lakes. A part of the department belongs to the Vosges Mountains. This, which comprises about a fourth of the whole, is rugged and the soil arid, but the low-lying basin is well watered and productive. In addition to cereals, flax and hemp are extensively cultivated; the ordinary fruits generally thrive well, and some districts are almost covered with cherry plantations. Iron is extensively worked, but the main occupation is agriculture. Vesoul is the capital. Pop. 228,350.

Saône-et-Loire, a department of East-

Central France; area, 3330 sq. miles. It is divided by the northern Cévennes, and it takes its name from the two streams which bound the department on the south-east and west respectively. The finest part of the department lies in the valley of the Saône. The vine is cultivated around Mâcon and Châlon. Most cereals are raised, and the Saône Valley grazing-lands are excellent. The most important mineral is coal, of which there is an extensive field; iron and manganese are found. Within the department are the largest ironworks in France (Schneider, at Le Creusot), and there are numerous flour-mills, distilleries, potteries, and porcelain-works and glass-factories. Exports include the famous Charollais cattle, pottery, glass, porcelain, and bricks. Mâcon is the capital. Pop. 554,820.

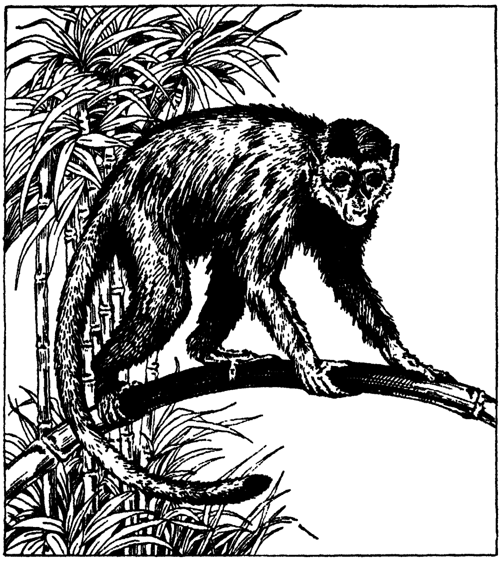
São Paulo, a maritime state of Brazil, between the two states of Minas-Geraes and Paraná; area, 112,278 sq. miles. The coast-line on the Atlantic has a length of 370 miles, and behind the narrow, lagoon-studded coastal plain rises the Sierra do Mar, a tableland with a slope towards the Paraná. The drainage is mainly towards that river, but in the east there is a slope to the Parahyba basin. The Rio Grande and other affluents of the Paraná traverse the state. São Paulo is famed for coffee, which is shipped through its port, Santos, the greatest coffee-shipping city in the world. About a half of the total Brazilian coffee crop is produced by the state; sugar, cotton, rice, maize, grapes, bananas, tobacco, and other crops are raised. Cotton and woollen textiles, beer, agricultural and other machinery, and food products are representative manufactures. São Paulo is the capital; Santos the chief port; other cities are Guaratingueta and Piracicaba. Pop. (state), 4,823,000.

São Paulo, a city of Brazil, capital of the state of São Paulo, on the Tieté River; the centre of the State railways. Although within the tropics, its great height (2300 to 2400 feet) gives the city an almost temperate climate. There is an enormous Polytechnic School, a college of agriculture, and many old religious buildings. There are considerable manufacturing industries. Pop. 504,000.

São Thomé and Principe,[1] two hilly, volcanic, Portuguese islands in the Gulf of Guinea, about 125 miles from the West African coast, forming together the province of São Thomé under a Governor. The total area is about 360 sq. miles (Principe = 60 sq. miles), and the pop. about 58,900 (Principe = 5000). At Principe cocoa is the chief industry, and the tse-tse fly, with its attendant scourge of sleeping-sickness, is prevalent. São Thomé produces quinine, rubber, kola-nuts, cinnamon, and camphor. Part of the island is densely afforested. Roughly one-sixth of the world's cocoa supply comes from the province; coffee is also produced.

Sap, the juice or fluid transported in the conducting tissues of plants. The term is applied more particularly to the *ascending* or *crude sap* that circulates in the wood-vessels, consisting normally of the very dilute solution of mineral salts absorbed by the roots, but at certain seasons containing also appreciable quantities of sugar.

Sapajou (sap′a-jö), the name generally given to a group of South American prehensile-tailed monkeys, including about twenty species, among which may be named the *Cebus fatuellus,* or brown sapajou (a variety is called the horned sapajou or capuchin); the *C. monachus* and *C. capucinus,* often called the weeper sapajou or capuchin. They are small in size, playful in disposition, leading a gregarious life, and feeding chiefly on fruits and insects.



Sapajou (*Cebus capucinus*)

Sapan-wood, or **Sappan-wood,** the wood of the *Cæsalpinia Sapan,* a middle-sized leguminous tree, indigenous to Siam, Burmah, India, &c., used as a dye-wood. The dye it yields is of a red colour, but rather inferior.

Sap-green, a pigment prepared by evaporating the juice of the berries of *Rhamnus catharticus,* or the buckthorn, to dryness, mixed with a little alum. It is used chiefly for colouring food-products.

Sapinda′ceæ, a natural order of polypetalous dicotyledons. It consists of trees or shrubs with erect or climbing stems, inhabitants of most parts of the tropics. The fruit of the *Sapindus saponaria* is used for washing linen.

---

[1] The anglicized titles of *Saint Thomas* and *Princes* are frequently used in reference to these islands, but the official title is as above, which is also, incidentally, that used by the Permanent Committee of the Royal Geographical Society.

Sapodilla, a tree of the genus Achras, the *A. Sapota*, nat. ord. Sapotaceæ, found in the West Indies, where it is called *naseberry*. The fruit resembles a bergamot pear, and has a sweet edible pulp. The tree yields the gum *balata*, or *chicle* (see *Bullet-tree*).

Saponification, the decomposition of a fat by caustic alkali, with the formation of a soap and glycerine. The word is also used as practically equivalent to *hydrolysis*, the general term for the process of resolution of a compound into two products, accompanied by the introduction of the component hydrogen and hydroxyl groups of water into those products. Typical examples of hydrolysis are: (1) Stearin treated with caustic potash yields potassium stearate (soft soap) and glycerol. This is saponification proper. (2) An ester treated with hot water or boiled with mineral acid yields an acid and alcohol.

Sap′onine, any of a group of vegetable glucosides found in the root of the Soapwort (*Saponaria officinalis*) and many other plants. It is soluble in water, and its solution even when much diluted froths on being agitated, like a solution of soap; on this account it is sometimes used for producing 'heading' on beverages. The dry substance causes sneezing.

Sap′onite, a hydrous silicate of magnesia and alumina. It occurs in soft, soapy, amorphous masses, filling veins in serpentine and cavities in basaltic rock.

Sapota′ceæ, a natural order of plants belonging to the polycarpous group of gamopetalous dicotyledons, and frequently abounding in a milky juice, which may be used as food. They are chiefly natives of India, Africa, and America. Some produce edible fruits, as the sapodilla plum, marmalade apple, star apple, &c. One of the most important species is the *Isonandra* (*Palaquium*) *Gutta*, which produces the gutta-percha of commerce.

Sapphire (saf′īr), a precious stone, next in hardness and value to the diamond, belonging to the corundum class. Sapphires are found in various places, as Burmah, India, and Ceylon, in Asia; and Bohemia and Silesia, in Europe. The sapphire proper is a beautiful transparent stone of various shades of blue colour. See *Corundum*.

Sappho (saf′ō), Greek poetess, lived probably at the end of the seventh and the beginning of the sixth centuries B.C. She was a native of Mitylene, in Lesbos. Almost nothing is known about her life, but many of her biographers, being indebted to their imaginations for their facts, have written a detailed account of her. It seems quite certain that she was never in love with Phaon, who appears to have been merely a variant of the sun-god Phaethon; nor did she make her celebrated leap from the Leucadian rock, this legend owing its origin to some religious rite performed there, and erroneously associated with Sappho's name. The only fact about her life of which we can be tolerably certain is that she was the head of a kind of school of women poets. It is probable that she lived to middle-age, at any rate. Some two hundred years after her death Sappho became a sort of stock character on the Athenian stage. Six middle comedies entitled *Sappho* and two entitled *Phaon* were produced. It is to the exaggerations of the comic poets that Sappho mainly owes her bad reputation. Her character was first cleared by Welcker in 1816, but with Teutonic thoroughness he was not content with proving her less depraved than was supposed, but extolled her as a paragon among women. There is not a great deal of evidence to go upon, but it is probable that Sappho was neither a courtesan nor a prude, but a typical woman of her time and country, raised above the average by her passionate heart and her brilliant intellect. Many of the aspersions of the Attic dramatists may be explained by the fact that Lesbian women had far more liberty than those of Athens, and in those days the emancipated woman was looked upon with suspicion.

Amongst all the losses of Greek literature which are to be deplored none is greater than the loss of the poems of Sappho. Her reputation in the ancient world was unparalleled. She was 'The Poetess' just as Homer was 'The Poet'. Plato called her "the tenth Muse". Aristotle ranked her with Homer and Archilochus. Longinus cited her *Ode to Anactoria* as an example of the grand style in poetry. The scanty fragments of her work which are preserved bear out this great reputation. She stands with Catullus and Shelley as the greatest of lyric poets. Catullus owed much to her, used her favourite metre, and translated her *Ode to Anactoria*, but even his translation when placed beside the original looks like a mere academic exercise. All her lines are exquisitely finished, sound and sense correspond exactly, and each ode is balanced with the most faultless skill. In fact, there is just one epithet to apply to her work: it is perfect.

The Sapphic metre was invented by Sappho, and often used by her, though she made use of many other metres as well. Catullus and Horace popularized this stanza in Latin. As adapted by Horace it scanned as follows:

— ◡ — — — ◡ ◡ — ◡ — —
Integer vitae | scelerisque purus
— ◡ — — — ◡ ◡ — ◡ — —
non eget Mauris | iaculis nec arcu,
— ◡ — — — ◡ ◡ — ◡ — —
nec venenatis | gravida sagittis,
— ◡ ◡ — —
Fusce, pharetra.

The metre has frequently been imitated in English, but never more happily than by Canning in his *Friend of Humanity and the Knife-grinder*:

> I give thee sixpence! I will see thee damned first,—
> Wretch! whom no sense of wrongs can rouse to vengeance!—
> Sordid, unfeeling, reprobate, degraded,
> Spiritless outcast!

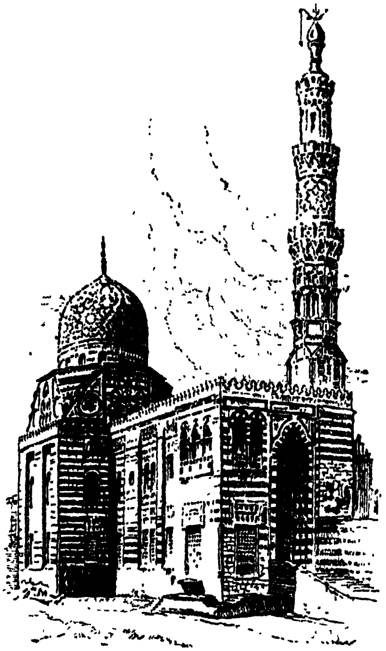
Saprolegnia, a genus of Fungi which grow on dead and living animals and plants in water, and form the characteristic feature of the salmon disease. The genus is the type of the family Saprolegniaceæ, group Oōmycetes.

Saprophytes, plants that feed on dead organic matter. Some saprophytes, certain Fungi in particular, are ready to absorb decaying matter of almost any kind, but others are very exclusive in this respect. For instance, certain agarics occur only on mouldering pine-needles, one species of Fungus grows only on cow-dung, another only on that of mice, while various mosses are equally fastidious. All saprophytic higher plants have mycorhiza (q.v.).

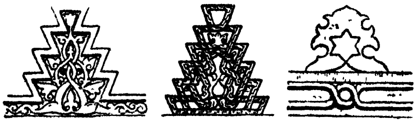
Sapucaia Nut, the seed of the *Lecythis ollaria* and the *L. Zabucajo*, trees which flourish in the virgin forests of Brazil. The fruit is shaped like an urn, is as large as a child's head, and opens by a lid which falls off when ripe. Each fruit encloses several seeds or nuts of a very agreeable flavour.

Saracen, an Arabian or other Mussulman of the early and proselytizing period; a propagator of Mahommedanism in countries lying to the west of Arabia. By mediæval writers the term was variously employed to designate the Arabs generally, the Mahommedans of Syria and Palestine, or the Arab-Berber races of Northern Africa. At a later time it was also applied to any infidel nation against which crusades were preached, such as the Turks.

Saracenic Architecture, the style adopted by the followers of Mahomet in building their mosques, palaces, and tombs. Originally the Arabs possessed no distinctive architectural style, and the style which they at length made their own was developed by architects belonging to the countries which they had conquered. This style is chiefly represented in Egypt, Persia, Spain, Turkey, and India, but the Saracenic architecture of Spain is generally called by the distinctive name of Moorish. (See *Moorish Architecture.*) The most prominent features of the style are the dome, the minaret, and the pointed arch. The Saracenic domes rise from a square base, are graceful in form, sometimes in groups of three or more, and frequently enriched externally with coloured tiles or other decorations. The minarets are slender towers of considerable height, rising in stages or stories, each with a balcony, and are most frequently octagonal, sometimes cylindrical, rising, however, from a square base. The arch is of the pointed variety, this form of arch having been used by the Arabs in Egypt before the rise of the Gothic in Europe. It is sometimes of the horse-shoe form. (See *Arch.*) The use of clustered pendentives (*honeycomb work*) to form a transition from the quadrangular area under a dome to the arch of the dome itself is very peculiar and common. Externally the tops of walls are often finished off with an upright cresting, which may be regarded as an ornament taking the place of a cornice. Flat surfaces are freely ornamented with a profusion of scroll-work and conventional foliage, often in intricate and beautiful designs. Stucco is much used in ornamentation. The mosque al-Akṣa at Jerusalem, reconstructed by Abd al-Melik in A.D. 691, shows evidence of the Christian art of the time in its basilica of seven aisles. In Egypt the Saracenic art began with the mosque which Amru erected at Old Cairo in the twenty-first year of the Hejra (A.D. 642). Subsequently repaired and altered, it may now be considered as a good specimen of Muslim architectural art when freed from Christian influence. But the perfected Saracenic art dates from the building of a mosque at Cairo by Ibn Ṭulûn in A.D. 876. This building is nearly square (390 by 455 feet) with a central court, around which on three sides are two ranges of arcades, while on the side towards Mecca there



Saracenic Architecture. Mosque of Ḳâ'iṭ-Bey, Cairo are five. It is built of brick covered with stucco. When the Turks captured Constantinople in 1453, they appropriated the Christian churches of the city, the most important of which was St. Sophia. Such was their appreciation of this Byzantine building, that they adopted its architectural style with modifications in all the mosques which they subsequently built there. In Persia the Saracenic architecture is supposed to be a development of the old Babylonian or Assyrian. The most splendid of Saracenic buildings in Persia, the Maidan Shah, was built during the dynasty of the Sufis by Shah Abbas (1585–1629) in his capital of Isfahān. See *Indian Architecture*.



Saracenic Architecture. Various patterns of wall-cresting

Saragossa, or **Zaragoza**, a city of Aragon, Northern Spain, capital of the province of Saragossa and of the ancient Kingdom of Aragon, on the Ebro. The principal buildings are the two cathedrals, La Seo and del Pilar. Other buildings are the vast archiepiscopal palace; the exchange, almhouse and hospitals (civil and military), and San Pablo church (thirteenth century), the old irregular citadel called the Aljaferia, built by the Moors; and the university of three faculties, founded in 1474. The chief manufactures are silk, woollen cloth, leather, soap, and hats. Pop. 117,750.

Saraikela, a feudatory state of India, in Bihar and Orissa, drained by the Kharkai and other streams. Area, 449 sq. miles; pop. 150,000.

Saran, a district of India, in the Tirhut division of Bihar. Rice is the staple crop; maize, barley, pulses, oil-seeds, and sugar-cane are cultivated. The chief places are Chapra, Siwān, and Gopalganj. Area, 2764 sq. miles; pop. 2,400,000.

Sarasa'te, Pablo Martin Meliton de, Spanish violinist, was born in 1844, died in 1908. His playing was specially characterized by purity and grace of style, and faultlessness of execution. He was in the best sense of the word a virtuoso.

Sarato'ga Springs, a city of New York, United States, in Saratoga county. It owes its prosperity to its mineral-springs, over forty in number, which have made it the most fashionable watering-place in the United States. The springs are characterized by their saline and chalybeate ingredients, heavily charged with carbonic acid gas. Pop. 13,180.

Sara'tov, a former government of South-Eastern Russia, in the Volga basin, lying along the Volga, which separates it from Samara and Astrakhan, and occupying the eastern region of the Russian Central Plateau. The Volga tributaries are small, and those draining to the Don are of most importance to Saratov. Saratov, Tsaritsyn, Kamyshin, and Khvalynsk are the chief ports.

Saratov is one of the chief grain-growing areas of Russia, rye, wheat, barley, oats, and millet being produced. Peas and lentils are grown in large quantities, and the sunflower is cultivated, the seeds (92,000 tons produced in 1914) being eaten raw by peasants and workpeople. Fruit-gardening is followed on the north bank of the Volga, mainly by German colonists. There are large sheep-, pig-, cattle-, and horse-breeding industries. Potatoes are used in enormous quantities for the production of industrial alcohol; and the flour industry and the Tsaritsyn timber trade are important. Oak, elm, ash, maple, lime, poplar, and aspen trees flourish in the forestal area. Cement is manufactured in a factory near Saratov; sheep-skins and unwoven woollen goods, especially carpets made near Tsaritsyn, are also produced. Area of government, 32,614 sq. miles; pop. (1913), 3,070,000 (2,640,000 lived in the country, and 426,400 in the towns).

Saratov, a town of Russia, capital of the pre-Revolutionary government of Saratov, on the Volga. It is a market town where oils, tallow, and animal fats come to market; at Krasnoi-Yar, an adjacent town, there is a large live poultry and geese market. There are also distilleries, flour-mills, oilworks, and railway workshops. Pop. (1913), 235,500.

Sara'wak, a state and British protectorate of North-West Borneo, Malay Archipelago. It has a coast-line of 500 miles between Cape Datu (south-west) and the Barram River (north-east), which separates it from Brunei, and behind the coastal plain rise a series of broken mountain chains (10,000 feet altitude), furrowed by numerous river valleys, and combining the functions of watershed and of frontier with Dutch Borneo. The drainage is entirely to the China Sea, the principal rivers being the Barram (navigable for 100 miles), Bintulu, Oya, Rejang (the largest, navigable for 160 miles), Batang-Lupar, Limbang, Sadong, Samarahan, and Sarawak (navigable for 20 miles). *Area, &c.*—The area is 50,000 sq. miles; pop. 650,000, comprising Malays, Dyaks, Kenyahs, and Kayans, with some Chinese and other emigrant settlers. *Production.*—Sago-flour, pepper, plantation rubber, gutta-percha, cutch (or gambier, a substance obtained from a shrub, used as an astringent and in tanning and dyeing), tobacco, rice, rattans, birds' nests, petroleum, and fish. *Towns.*—Kuching or Sarawak, at the head of navigation on the Sarawak River, is the capital (pop. 30,000); Sibu lies 60 miles from the mouth of the Rejang

River, and has a wireless station; and Miri has also a wireless station. The two stations, with those at Sadong and Goebilt, are in communication with Singapore. *Currency.*—The unit of currency is the dollar = 2*s.* 4*d.* sterling. *Communications.*—The road system of about 45 miles is confined to the area adjoining Kuching. *Government.* — The Raja (H.H. Charles Vyner Brooke) is absolute, and the succession is hereditary in his House. All superior appointments in the Civil Service (fifty in number) are held by Europeans appointed directly by the sovereign. A military and police force (700 men, mainly Malays and Dyaks) is maintained under British officership.

History.—In 1842 Sir James Brooke (q.v.) obtained portions of Sarawak from the Sultan of Brunei, and considerable accessions of territory were made in 1861, 1882, 1884, 1890, 1901, and 1907. The British protectorate was formally established in 1888. The Governor of the Straits Settlements is nominally Agent for North Borneo and Sarawak, and High Commissioner for Brunei.—BIBLIOGRAPHY: Sir Charles Brooke, *Ten Years in Sarawak (1853–63)*; Sir S. St. John, *Life of Sir Charles Brooke, Raja of Sarawak.*

Sarci'na is a micrococcus of the Fungus type which causes fermentation. It does not appear to have pathogenic effect on the human body.

Sarco'ma, the name formerly given by medical writers to any tumour of a fleshy or moderately firm tissue, but by Virchow used to designate a tumour composed of some modification of embryonic connective tissue. Sarcomata are of various grades of malignancy.

Sarcoph'agus (Gr. *sarkophagos*, flesh-eating, from *sarx*, flesh, and *phagein*, to eat), a coffin or tomb of stone; a kind of stone chest, generally more or less ornamented, for receiving a dead body. The oldest known sarcophagi are Egyptian, and have been found in certain of the pyramids. Two of the most celebrated of these are the great sarcophagus taken by the British in Egypt in 1801, now in the British Museum, and the alabaster sarcophagus in the Soane Museum, London. Sarcophagi were also used by the Phœnicians, Persians, and Romans; and in modern times stone coffins have not been uncommon for royalty and persons of high rank.

Sard, a variety of chalcedony, which displays on its surface a rich reddish-brown, but when held between the eye and the light appears of a deep blood-red carnelian.

Sardine (*Clupea pilchardus*), a small fish, now regarded as identical with the pilchard in its young stage, abundant in the Mediterranean and also on the Atlantic coasts of France, Spain, and Portugal. Large quantities are preserved by being salted and partly dried, then scalded in hot olive-oil, and finally hermetically sealed in tin boxes with hot salted oil, or oil and butter.

Sardin'ia (It. *Sardegna*, Gr. *Sardo*), a large Italian island in the western basin of the Mediterranean, separated from Corsica by the Strait of Bonifacio. It forms a province of Italy, as follows:

Departments.	Area.	Population.	Per sq. Mile.
Cagliari	5179	538,270	103·9
Sassari	4120	342,590	83·2
Sardinia	9299	880,860	94·7

The capital is Cagliari (pop. commune, 61,180); other important towns are Sassari (43,500) and Iglesias (20,000). *Production: Agriculture.*—Crops include a little grain, but in ancient times Sardinia was one of the granaries of Rome. Viticulture is general where conditions are suitable; olives, tobacco, and vegetables are generally grown. *Minerals.*—Sardinia, around Cagliari, Sassari, and Iglesias, is one of the most important of Italian mining centres, and many mines were known to the Carthaginians and the Romans. Zinc, lead, silver, manganese, antimony, lignite, coal, copper, and salt are among the minerals extracted. *Fisheries.*—Tunny-fisheries are important; sardines and lobsters are exported, and trout are found in the mountain streams. The Sardinians are not a seafaring people, and do not develop the sea-fisheries themselves to any considerable extent.

History.—Sardinia was formerly a kingdom, composed of the Island of Sardinia, the Duchy of Savoy, the Principality of Piedmont, the County of Nice, the Duchy of Genoa, and parts of the Duchies of Montferrat and Milan. In 1720 Victor Amadeus II, Duke of Savoy, on receiving the Island of Sardinia in exchange for Sicily, took the title of King of Sardinia. He was succeeded by Charles Emmanuel III, Victor Amadeus III, and Charles Emmanuel IV, who in 1802 abdicated in favour of his brother, Victor Emmanuel I, the royal family having by this time, during the domination of Napoleon, taken refuge on the Island of Sardinia. In 1814 the king returned to Turin, where the seat of government was established. An insurrection occasioned his abdication in 1821 in favour of Charles Felix, who, after a reign of ten years, was succeeded by Charles Albert. In 1848 he headed the league which endeavoured to drive the Austrians from Italy. The defeat of the Sardinian forces at Novara (1849) by Radetzky, however, caused him to abdicate in favour of his son, Victor Emmanuel II. The position of Sardinia was strengthened by the part which it played (1854) in the Crimean War, while in 1859 the co-operation of France was secured in a war against Austria. The brief campaign which followed ended in the defeat of the Austrians at Magenta and Solferino, and led to Sardinia receiving a large increase of territory, though she had to cede Savoy and Nice to France. Soon after this the Sardinian Kingdom was merged in a united Italian Kingdom under Victor Emmanuel. See *Savoy, House of.*

Sard′onyx, a precious stone, a beautiful and rare variety of onyx, consisting of alternate layers of sard and white chalcedony.

Sardou, Victorien, French dramatist, born at Paris in 1831, died in 1908. The son of a professor, he at first studied medicine, but abandoned this in favour of literature. His earliest venture was the comedy of *La Taverne des étudiants*, which proved a failure at the Odéon. He was successful, however, with two plays which he wrote for Déjazet called *M. Garat* (1860) and *Les Prés-Saint-Gervais* (1862). His better-known works, many of them produced in England, are *Les Pattes de mouche*, *Nos Intimes*, *La Patrie*, *Daniel Rochat*, *Thermidor*, *Madame Sans-gêne*, *Robespierre*, and *Dante*. Some of his successes were associated with Madame Bernhardt, for whom he wrote *Fédora*, *Théodora*, and *La Tosca.*

Sargent, John Singer, painter, was born in 1856, his father being an American physician. He is especially famous as a painter of portraits, among his works in this department being those of Carolus Duran, Ellen Terry, and Joseph Chamberlain. He died in 1925.

Sark, one of the Channel Islands, situated about 8 miles from Guernsey. It is divided into Great Sark and Little Sark, the connection between these being a narrow neck of land, a natural causeway, called the Coupée; length about 5 miles, and breadth about 3 miles. Fishing and agriculture are the chief employments. Pop. 600.

Sarmatians, a people of supposed Asiatic race, who, in the time of the Romans, occupied the vast region between the Black, Baltic, and Caspian Seas. They were a nomadic race.

Sar′nia, a city and port of entry of Ontario, Canada, the capital of Lambton county, on the St. Clair River. There are lumber-mills and industries in oil-refining. The city is connected by the St. Clair Tunnel (Grand Trunk Railway) with Port Huron, Michigan. Pop. 10,000.

Sarno (ancient **Sarnus**), a town of Campania, South Italy, in the province of Salerno; served by rail from Naples. Near by there are mineral-springs; linen, cotton, silk, hemp, and paper goods are made. Pop. 15,000.

Sarotham′nus, a genus of leguminous plants. *S. scoparius* is the well-known broom, the *Cytisus scoparius* of De Candolle.

Sarpi, Paolo, known also as Fra Paolo, born at Venice 1552, died 1623. He entered the order of the Servites, and became their procurator-general in 1585. Sent to the Venetian Republic as representative from Pope Paul V in the controversy of Church and State, Sarpi upheld the claims of the Republic, and in consequence was excommunicated. In the seclusion of his cell he wrote and published, under the pseudonym of Pietro Soave Polano (an anagram of Paolo Sarpi Veneto), an elaborate attack on Papal policy called *Istoria del Concilio Tridentino* (History of the Council of Trent).

Sarracenia′ceæ, a natural order of polypetalous dicotyledons which consists of herbaceous perennial plants, remarkable for their pitcher-like leaves. There are three genera (Sarracenia, Darlingtonia, and Heliamphora) the species of which are inhabitants of northern or tropical America.

Sarreguemines, a town of France, in the department of Moselle. It is a railway junction, and has pottery and other manufactures. During the war of 1870–1 it fell to the Germans, but was restored to France in 1919. Pop. 16,000. See *Saar.*

Sarsaparil′la, the rhizome of several plants of the genus Smilax. *S. medica* supplies the sarza of Vera Cruz. *S. papyracea* yields the Lisbon or Brazilian sort. *S. officinālis* yields the kinds known as Jamaica and Honduras sarsaparilla. Sarsaparilla is used in the treatment of rheumatism and skin diseases, but its efficacy is dubious.

Sar′sia (from the Norwegian naturalist *Sars*, 1805–69), a name applied to the sexual medusa stage of certain hydrozoa of the family Corynidæ. It possesses four slender tentacles and a very long manubrium, on which, in some species (*S. prolifera* and *S. siphonophora*), another generation of medusæ is produced by budding.

Sarthe (sȧrt), a department of North-West France; area, 2410 sq. miles. It is low and undulating except in the north and east, where the country is broken and hilly. Wheat, oats, barley, beet-root, apples, and hemp are grown, while cider and wine are largely produced. Coal and marble are found. Hemp- and flax-weaving are the chief industries, but there are many other industrial establishments. The capital is Le Mans; other towns are La Flèche, Sablé, and La Ferté. Sarthe includes the eastern part of the pre-Revolutionary province of Maine, and parts of Perche and Anjou. Pop. 389,240.

Sarto, Andrea del, properly Andrea d'Agnolo, Italian painter, born at Florence 1486, died there 1531. A pupil of Piero di Cosimo, he was strongly influenced by Fra Bartolommeo. In 1518 he visited France at the invitation of Francis I, but soon returned to Italy. He combined superb draughtsmanship with harmonious colour and monumental design, but notwithstanding the perfection of his technique, which won him the title of *il pittore senz'errore* (the perfect painter), he often lacks emotional conviction and imaginative power. He painted in Florence many important frescoes, including the series dealing with the life of the Virgin in the church of the Annunziata, that illustrating the life of St. John in the Scalzo, and the fine *Last Supper* at S. Salvi. Among his chief easel pictures are the *Sacrifice of Abraham* and *The Marriage of St. Catherine* (Dresden), *The Madonna di San Francesco* and *The Assumption* (Florence), and the *Virgin and Child* (Madrid). He is not well represented in England, but the National Gallery has a good *Portrait of a Sculptor*, and the Wallace Collection a characteristic *Virgin and Child.*

Sarum, Old, an ancient and now deserted borough in Wiltshire, 2 miles north of Salisbury. It was once a considerable city, and two members, up to the passing of the Reform Bill of 1832, were returned to Parliament by the proprietors. It was the original situation of Salisbury (New Sarum), and the bishop had a castle there, but the see was removed to Salisbury in the year 1219.

Sarza′na, a city of Liguria, North Italy, in the province of Genoa. There is an important glass-bottle works, and bricks are made. Pop. 15,000.

Saseho, or **Sasebo**, the third naval port of Japan, on the west coast of Kyushu, and served by rail to Nagasaki and Fukuoka. Light cruisers and similar ships are constructed in the imperial dockyard. Pop. 123,600.

Sa′sin, or **Black-buck**, the common Indian antelope (*Antilope cervicapra*), remarkable for its swiftness and beauty. It is abundant in the open dry plains of India, in flocks of from ten to sixty females to a single male. It stands about 2 feet 6 inches high at the shoulder.

Sasine (sā̆′zin), in Scots law, the act of giving legal possession of feudal property (*infeftment*), or the instrument by which the fact is proved. There is an office for the registering of sasines in Edinburgh.

Saskatch′ewan, a great river of Canada, which rises in the Rocky Mountains (52° ·07′ N. and 117° ·06′ W.) by two principal heads, the North and South Saskatchewan respectively, which unite at Prince Albert and empty into Lake Winnipeg. The total course of the combined streams is 800 miles, and navigation is possible for shallow-draught vessels between the embouchure and Edmonton, on the North branch (850 miles).

Saskatchewan, a province of Western Canada. In the south it is mainly a gently rolling, treeless prairie, above which are 'bluffs' of birch and poplar, changing to extensive forests, but thinning out towards the northern border. Traversing the province from east to west is the Saskatchewan River; other rivers are the Churchill, which empties into Hudson Bay, the Qu'Appelle, and the Souris. There are eleven lakes of over 100,000 acres in area. The provincial temperature varies between 100° F. (summer) and 0° F. (winter), but the climate varies considerably with latitude. *Area, &c.*—Area (including 8318 sq. miles of water), 251,700 sq. miles (390 miles east and west and 760 miles north and south); pop. (1921), 761,890. *Cities.*—Regina (pop. 50,000) is the capital; other cities are Moose Jaw (19,200), Saskatoon (28,000), Prince Albert (8500), and North Battleford (5000). *Production.*—Agricultural pursuits include apiculture, dairying, and the production of butter, milk, cream and ice cream, and wheat (58 per cent of all Canadian spring wheat), oats, barley, flax (of which the province is the chief Canadian source), and root crops, with cattle-, poultry-, and sheep-raising. Fisheries include trout, whitefish, pike, and perch. East of Prince Albert is a heavily timbered district, and that town is the centre of provincial lumbering. Mining is developing steadily; coal, copper, glass sand, gold, hematite, limonite, mineral pigments, natural gas, peat, petroleum, salt, and sodium sulphate (Glauber's salt) are found. Manufactures include fibres and linens, leathers, and clay products.

Saskatoon, a city of Saskatchewan, Canada, on Saskatchewan River; served by the Pacific and National Railways. It is the mid-western head-quarters of the latter system, and is a distributing centre for 47,000 sq. miles of territory. Industries include flour-mills, Quaker Oats factory, brewery, tractor-works, clothing manufactures, and sawmills. Pop. 28,000.

Sas′saby, or **Bastard Hartebeest** (*Bubalis lunāta*), an antelope found in South Africa, in small herds of six to ten. The body is reddish-brown, the limbs are of dark hue, and a dark stripe marks the forehead and midface.

Sas′safras, a genus of plants, nat. ord. Lauraceæ. The best-known species is the *S. officinale* (the sassafras laurel). It is a small tree or bush inhabiting the woods of North America. The taste of sassafras is sharp, acrid, and aromatic; it is used for flavouring purposes, and in medicine as a stimulant.

Sassan′idæ, or **Sasanians**, a national dynasty of Persia which succeeded that of the Arsacidæ in A.D. 226. The founder of the dynasty was Ardashirl (Artaxerxes), son of Papek, son of Sassan. During the period of the Sassanidæ the Persian Empire, in consequence of successful wars, was greatly extended. Zoroastrianism became the national faith, and literature flourished. The dynasty came to an end with Yezdegerd III (632–651), when Persia was conquered by the Muslims.

Sas'sari, a city of Sardinia, capital of the province of Sassari, on the Torres River, on the railway from Porto Torres to Ozieri. It is an archiepiscopal see, the seat of a university, and is the chief town of Sardinia after Cagliari. Pop. 44,000.

Sas'solin, native boracic acid, soluble in water, occurring as a deposit from hot springs and ponds in the lagoons of Tuscany, and first discovered near *Sasso*. Its extraction is an important industry.

Sata'ra, a district and city in the Bombay Presidency, India. The district forms part of the tableland of the Deccan, and is traversed by the main range of the Western Ghâts and by the Mahādeo range, which throw out spurs forming the valleys of the headwaters of the Kistna. Many food products are raised for the Bombay market, but the rainfall is so small and so uncertain that crops are peculiarly liable to failure. Manganese occurs in places, and iron is abundant. The chief municipality is Satara City, which is the district head-quarters. Area (state), 4825 sq. miles; pop. (state), 1,200,000; (city), 27,000.

Sat'ellite, a secondary or smaller planet revolving round a larger one. The earth has one satellite, called the moon; Neptune is also accompanied by one known satellite; Mars by two; Uranus by four; Jupiter by nine; and Saturn by at least nine.

Satin, a soft, closely woven silk, with a glossy surface. In the manufacture of satin part of the weft is left beneath the warp, which, presenting a close and smooth surface, acquires, after being passed over heated cylinders, that lustre which distinguishes it from other kinds of silks.

Satin-spar, a name given to fibrous varieties of the minerals calcite and gypsum, distinguished by a silky lustre.

Satin-wood, the wood of a large tree of the genus Chloroxylon, the *C. swietenia*, nat. ord. Cedrelaceæ. It is a native of the mountainous parts of the Circars in the East Indies. The wood is of a deep-yellow colour, close-grained, heavy, and durable.

Satire (Lat. *lanx satura*, a full dish, used of a charger laden with first-fruits and given to Bacchus or Ceres; so 'a medley'. There was, however, some confusion with the Gr. *satyros*, a satyr, and consequently with the satyr-plays, of which the *Cyclops* of Euripides is the only example extant), a poem or prose composition in which prevailing follies or vices are held up to ridicule.

Satire is Roman in the derivation of its name, and is in a narrow sense Roman in its origin, being the only branch of Latin literature which is not modelled upon Greek originals. In a broader sense, however, satire is as old as civilization, and there are several Greek writers who must be classed as satirists. If tradition is true, Homer himself wrote a satire—the *Margites*, which satirized a type even nowadays not uncommon—one who knew many things and knew them all badly. Archilochus (720–680 B.C.) wrote lampoons of a particularly virulent kind. Some of his victims are said to have hanged themselves. Simonides of Amorgos and Hipponax wrote vigorous satires. The writers of Old Comedy, of whom Aristophanes is the chief, might be regarded as satirists were it not that they were so much else besides.

The earliest of Roman satirists is Lucilius (148–103 B.C.). His satire was of the biting kind; Horace tells us that he lashed the city (Rome). Varro wrote voluminous satires, partly of an autobiographical nature, in a curious mixture of prose and verse. Only inconsiderable fragments are extant. Horace's *Satires*, the quintessence of playful urbanity and amiable worldliness, have given delight to every succeeding generation, and formed the model for much later satire. The philosophical satires of Persius, who died when little more than a boy, must also be mentioned. Of fierce rhetorical satirists none is greater than Juvenal, who gives a striking if somewhat lurid picture of his time. He also had much influence over mediæval and modern satirists. Petronius's unique novel the *Satiricon* was written, like Varro's satire, in a mixture of prose and verse. In many ways, especially in the Dinner of Trimalchio incident, Petronius forestalled the modern novelists. Apuleius's extraordinary work *The Golden Ass* contains much shrewd satire. The last and one of the greatest of ancient satirists was a Greek and not a Roman. Lucian's dialogues and other writings are satires of a high order of merit, and have often been imitated. His *True History* is the direct ancestor of *Gulliver's Travels* and *Erewhon*.

In the Middle Ages *Reynard the Fox* must be mentioned as an important satire. Jean de Meung's contribution to the *Roman de la Rose* is also satirical. Langley's *Piers Plowman* is a satire of a very remarkable kind, attacking vices in Church and State, particularly in the former. Skelton wrote much satire, but most of it does not rise above the level of doggerel. Nash was a vigorous writer, and employed satire as his principal weapon. George Buchanan, the great Scottish humanist, wrote satires of a very effective kind. Erasmus, following the model of Lucian, wrote many brilliantly clever satires wherein he displays a happy combination of learning and humour. Rabelais is a satirist and much more than a satirist, and the same applies to the immortal Cervantes.

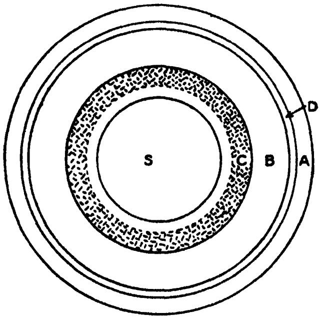
The *Argenis* of Barclay is a political satire of the Petronian type. Donne and Marston wrote satires on the classical model. Andrew Marvell wrote some political satires of much ability. Samuel Butler in his *Hudibras* wrote an eminently quotable satire on Puritanism. It is one of the wittiest poems in the language. Dryden is one of the most downright and formidable of British satirists; while in France, Boileau carried on the Horatian tradition. The early eighteenth century was the golden age of satire. Pope is the neatest and most pointed of satirists, all his writings being largely spiced with malice. Addison is a kind of prose Horace, polished and urbane. Arbuthnot, especially in his *History of John Bull*, is a political satirist of the first rank. But greater than them all, and for *sæva indignatio* the greatest satirist of all, is Swift. He was a titanic satirist, and in his *Gulliver's Travels*, particularly in the fourth book, he has written the most bitter satire that ever was penned on the whole human race. Dr. Johnson wrote some satires which are free paraphrases of Juvenal. Charles Churchill was a fierce and somewhat scurrilous satirist. The mysterious Junius, whoever he was, must take high rank as a satirist; and Burns, though chiefly loved for his songs and lyric poems, also wrote some excellent satirical poems (e.g. *Holy Willie's Prayer* and *The Holy Fair*). Voltaire was essentially a satirist, and a master of sarcastic mockery. Byron was led by the romantic revival to write much sentimental poetry, but he was a satirist of the first class, as *The Vision of Judgment* shows. The novels of Miss Austen contain much unsurpassable satire of a delicate and feminine kind. Peacock evolved his own peculiar type of novel, and embodied much witty satire in it. Thackeray was above everything else a satirist, the greatest perhaps of his age; and there is much delicate satire in the novels of George Meredith. W. S. Gilbert was a singularly happy and urbane satirist with an inimitable gift of inverted logic. Samuel Butler the Second in *Erewhon* and *Erewhon Revisited* followed in Swift's footsteps with some success, and in *The Way of all Flesh* he exploded the Victorian theory of the infallibility of the parent. No sketch of satire, however brief, would be quite complete without some mention of Mr. Punch, who, since his birth in 1841, has added to the gaiety of nations by satirical cartoons and letterpress. — BIBLIOGRAPHY: J. Hannay, *Satire and Satirists*; C. W. Previté-Orton, *Political Satire in English Poetry*.

Saturated, a word with many applications in physics and chemistry, in the general sense of 'holding as much as possible'. See *Dew*; *Dew-point*; *Steam*; *Vaporization*; *Solution*; *Paraffin Series*; *Ring in Chemistry*; *Valency*; *Magnetism*; *Ionization*.

Saturday (A.-Sax. *Sæterdæg*, *Sæterndæg*—*Sæter*, *Sætern*, for Saturn, and *dæg*, a day—the day presided over by the planet Saturn), the seventh or last day of the week; the day of the Jewish Sabbath.

Saturn, an agricultural god of ancient Italy, popularly but erroneously identified with the Greek god Cronus (q.v.), and by a further error sometimes identified with Time (Gr. *Chronos*). His reign was supposed to have been the Golden Age. His emblem was a sickle, the origin of Time's scythe.

Saturn is the second largest of the planets, and the most distant one known to the ancients.



Plan of Saturn's Ring System. The extreme breadth of exterior diameter of ring A is 170,000 miles

A, Outermost ring. D, Cassini division. B, Inner bright ring. C, Crêpe or Dusky ring (very transparent). S, Ball of planet.

It revolves round the sun in twenty-nine and a half years at a mean distance of 886,000,000 miles. Its equatorial diameter is 75,000 miles, and its polar 67,000 miles, the oblateness of form being greater than in any other major planet. Belts and spots are seen upon its surface, but much less distinctly than upon Jupiter. The period of rotation seems to vary greatly in different latitudes; for while a period of 10 hours 14 minutes has been deduced from a marking in low latitude, one in a higher latitude gave 10 hours 37 minutes. Doubtless, therefore, as in the case of Jupiter, we can see only the exterior surface of a shell of clouds or vapours surrounding the planet. Probably the interior temperature is very high, keeping the substance in an expanded state of low density. This is further shown by the fact that Saturn is lighter by nearly one-third than an equal bulk of water. Its volume is 768 times, its mass 95 times the earth's. It is surrounded by a marvellous system of rings, the most wonderful structure in the solar system. These consist of an immense multitude of miniature satellites, or meteoric bodies. The two outer rings are bright, separated by the Cassini division. Within the inner of the two is the semi-transparent crêpe ring. The entire diameter of the ring system is 170,000 miles. Its thickness is very small, so that at periods about fifteen years apart, when it is edgewise to the earth, it is temporarily invisible in small telescopes. Saturn is known to have nine satellites, of which the farthest, Phœbe, is over 7,000,000 miles from its primary, and revolves in a retrograde direction in about one and a half years. A tenth satellite was also supposed to have been detected photographically in 1905.—Cf. R. A. Proctor, *Saturn and its System.*

Saturna′lia, a festival held by the Romans in honour of Saturn, during which the citizens, with their slaves, gave themselves up to unrestrained freedom and mirth. It lasted under the Cæsars seven days, namely, from the 17th to the 23rd of Dec. While it continued, no public business could be transacted, the law courts were closed, the schools kept holiday, and slaves were freed from restraint. Masters and slaves even changed places, so that while the servants sat at table, they were waited on by their masters and their guests. In the last days of the festival presents were sent by one friend to another.

Satyrs, in Greek mythology, a class of woodland divinities, in later times, inseparably connected with the worship of Dionysus (Bacchus). The satyrs appear in works of art as half-man and half-goat, having horns on the head, and a hairy body with the feet and tail of a goat. For *Satyr-plays* see *Drama*; *Euripides.*

Saugor, or **Sāgar**, a district and town in the Jubbulpore division of the Central Provinces of India. The district forms with Damoh an extension of the great Mālwā Plateau, and is undulating, with numerous isolated hills; it is traversed by the Dhasān and the Sonār. The headquarters of the district is Saugor. State area, 3962 sq. miles; pop. 500,000 (87 per cent Hindu); pop. (town), 40,000.

Saul, King of Israel from about 1095 to 1056 B.C., and the son of Kish, a Benjamite. After a long reign Saul became mentally deranged, and did much evil. The prophet Samuel, estranged by the king's misdeeds, anointed David as his successor. Saul was slain by his own sword in a battle with the Philistines on Mount Gilboa.

Saumarez, or **Sausmarez** (sō′ma-rā), James, Baron de, a British admiral, born 1757, died 1836. He had a distinguished naval career, and in 1795 opened the battle of L'Orient, where the French fleet was defeated; he also shared in the victory off Cape St. Vincent (1797); and was second in command to Lord Nelson in the victory of the Nile (1798).

Saumur (sō-mür), a town of North-West France, in the department of Maine-et-Loire, on the Loire. It has a castle dating from 1240, now an arsenal and powder-magazine; three ancient churches; a court-house; town house; communal college; and a famous cavalry school founded in 1768, through which cadets from St. Cyr are passed on appointment to commissions in cavalry regiments. Sparkling white wines are extensively made in the neighbourhood. Pop. 16,390.

Saury-pike, a spiny-finned fish of the genus Scombresox, family Scombresocidæ, having a greatly elongated body, and a long sharp beak. One species, the skipper (*S. saurus*), about 15 inches long, occurs plentifully on the British coasts, frequenting firths in shoals. In order to escape the pursuit of the porpoise and large fishes, it often leaps out of the water or skims rapidly along the surface.

Savage, Richard, English poet, whose writings, mostly of a satirical nature, are forgotten. He is only remembered because of the elaborate life of him written by Dr. Johnson in 1744. Savage was born in 1697, and died after a life of dissipation in 1743. He claimed to be a son of the fourth Earl Rivers and the Countess of Macclesfield.

Savan′nah, a river of the United States, which forms the north-east boundary of Georgia, and separates it from South Carolina. It is formed by the junction of the Tugaloo and Keowee, above Augusta, and falls into the sea 18 miles below Savannah City. It has a length of 450 miles, and is navigable by small vessels to Augusta.

Savannah, a city and port of entry of Georgia, United States, the second city of the state and the county seat of Chatham county, on the Savannah River. Savannah is one of the great cotton ports, and has a large export trade. Fertilizers and cars are made. Pop. 83,250.

Sav′ary, Anne-Jean-Marie-René, Duc de Rovigo, French general, born 1774, died 1833. After the battle of Marengo he was appointed adjutant to Napoleon. He was sent to Spain to arrange for Joseph Bonaparte being made king, and in 1810 succeeded Fouché as Minister of Police.

Save, a river of Yugo-Slavia, formed by the junction at Radmansdorf of the Wocheiner Save and the Wurzener Save, both of which rise in the Triglav group in Carniola and, as the Save, flow to join the Danube at Belgrade after a course of 450 miles; drainage area, about 34,000 sq. miles. The principal tributaries are the Kanker, Sann, and Feistritz on the left, and the Zeier (Sora), Laibach (Ljubljaniça), Gurk

(Kerka), Kulpa, Una, and Bosut. The Save is noted for salmon; sturgeon and sterlet are also found. During the European War the Save Valley was the scene of much sanguinary fighting. See *Serbia*; *Yugo-Slavia.*

Savigliano, a city of Piedmont, North Italy, in the province of Cuneo, on the Maira; served by railway from Turin. It is an important industrial city. Pop. 19,000.

Savigny (sȧ'vin-yē), Friedrich Karl von, German jurist, the founder of the modern historical school of jurisprudence, born 1779, died 1861. His principal works are: *Geschichte des Römischen Rechts im Mittelalter*; *System des heutigen Römischen Rechts*, to which *Das Obligationsrecht* forms an appendix; and *Vermischte Schriften.*

Savings, National. The national savings movement, set on foot during the European War, was the outcome of a Government Committee appointed in Nov., 1915, to consider (*a*) the reduction of general consumption, (*b*) the raising of money for prosecuting the war.

As a result of the recommendations of that committee, War Savings Certificates were put on sale in Feb., 1916. Each certificate now costs 16*s*., increasing to 20*s*. by the end of five years. It is free of all income tax, can be realized at short notice, and is therefore guaranteed against depreciation. The holding of any one individual is limited to 500 certificates. (It is now possible to leave a certificate in the hands of the State for ten years, at the end of which time it is worth 26*s*.)

In the autumn of 1917 National War Bonds were issued. The total amount produced by their sale was £1,727,599,040. A further special campaign was conducted for the Victory Loan in 1919, when the amount subscribed was £768,648,495.

Post-War Work.—With the advent of peace the savings organization was asked to continue its work on behalf of the small investor.

A new feature has been introduced as from 1st Oct., 1920, by which any local authority can borrow from the State towards financing approved housing schemes up to 50 per cent of the gross proceeds of Savings Certificates sold in its area.

The steady advocacy of saving carried on in this work has had a beneficial effect on all thrift agencies, as will be seen from their statistics. It is, for instance, interesting to note that from Aug., 1914, to Jan., 1920, the total contributions of the small investor to State securities amounted to £566,631,000.

Savoie, a west-central department of France, on the Italian frontier, traversed by the Isère. Chambéry is the capital; Aix-les-Bains is within the department, and there are other mineral-springs, notably at Challes. Area, 2388 sq. miles; pop. (1921), 224,890.

Savoie, Haute-, a west-central department of France, on the Italo-Swiss frontier. It comprises the basins of the Arve, Dranse, Usses, and Fier, and is entirely covered with low hills. Annecy is the capital; Évian, St. Gervais, and Amphion have mineral-springs. Cluses is a clock-making centre, and Annecy has some cotton manufactures. Area, 1774 sq. miles; pop. 235,670.

Savo'na, a seaport of Liguria, North Italy, in the province of Genoa, an important city of the Riviera di Ponente. The industries include iron, pottery, silk, wool, glass, and paper. Pop. 50,000.

Savonaro'la, Girolamo, Italian preacher and political and religious reformer, born at Ferrara 1452, died 1498. Educated for the medical profession, he yet secretly entered the order of Dominicans at Bologna in 1475. In 1482 he was sent to St. Mark's convent at Florence. He was patronized by Lorenzo de' Medici, and became prior of St. Mark's in 1491. His sermons, in which he denounced the iniquity of the times, attracted crowds. Savonarola claimed to be a special messenger from God, and to have the gift of prophecy. After the death of Lorenzo and the expulsion of his son Piero, Savonarola put himself at the head of the democratic party and organized the city into a form of republic. But in his zeal he meditated the reform of the Roman court and of the irregularities of the clergy. To this end he wrote to the Christian princes, declaring that the Church was corrupt, and that it was their duty to convoke a general council. Alarmed at this, Alexander VI, who was then Pope, excommunicated him in 1497. A challenge to an ordeal by fire ended his reputation, and he was put to death by means of strangling in 1498. A faithful portrait of Savonarola is given in George Eliot's *Romola*. In his protests against Papal corruption, his moral earnestness, and his faith in the Bible as a guide to conduct, Savonarola showed himself a forerunner of the Reformation.—Cf. Villari, *Life and Times of Savonarola.*

Savory, the common name for plants of the genus Satureia, ord. Labiatæ, herbs and undershrubs used in cookery as a seasoning, particularly the Summer Savory (*S. hortensis*), an annual plant cultivated in kitchen-gardens.

Savoy. See *Savoie*; *Savoie, Haute-.*

Savoy, House of, one of the oldest royal Houses of Europe, now represented by a cadet branch, that of Savoy-Carignan, which occupies the throne of Italy. Humbert White Hand (Umberto Biancamano), the reputed descendant of Widukind, the last of the Old Saxon kings, was the first of the family who took a prominent place among the princes of Northern Italy. The family dominions continued to increase, and under

Amadeus II (1103–49) were raised to a county of the empire (1111), and now received the name of Savoy. Count Thomas I (1188–1233) obtained important accessions of territory in Chambéry, Turin, Vaud, &c. Amadeus IV (1233–53) obtained the submission of the city of Turin to his rule. Amadeus VI lent his aid to the Greek emperor John Palæologus, against the Turks and the Bulgarians, and united the lordships of Cherasco, Coni, Gex, and Valromey to his possessions. His son, Amadeus VII (1383–91), forced the Count of Provence to cede to him Nice and Ventimiglia. Amadeus VIII, grandson of the preceding (1391–1451), received the ducal title from the Emperor Sigismund in 1416, and acquired the county of Geneva, together with Bugey and Vercelli. The elder male line became extinct in 1496, and the crown devolved on the nearest collateral heirs, Philibert II (1497–1504) and his brother Charles III (1504–53). The latter aided the Emperor Charles V against Francis I of France, and was finally deprived of all his territories by the French king. But his son Philibert Emmanuel, surnamed the Iron Head (1553–80), succeeded in gaining back the greater part of the paternal domains. Charles Emmanuel I (1580–1630) was prompted to reconquer the marquisate of Saluzzo, but Henry IV of France invaded Savoy and Piedmont, and compelled the duke to give up Bugey, Valromey, and Gex. His son, Victor Amadeus I, regained these possessions, and added to them Montferrat, Alba, and some other places. Victor Amadeus II (1675–1730), grandson of the first of that name, at the beginning of the War of the Spanish Succession sided with France, but afterwards transferred his services to Austria. By the Treaty of Utrecht (1713) he received a part of the Duchy of Milan, along with the Island of Sicily, which conferred upon him the title of king; but in 1720 he was compelled to give up Sicily to Austria in exchange for Sardinia, which, along with Savoy, Piedmont, and his other dominions, became the Kingdom of Sardinia.—Cf. C. W. Previté-Orton, *The Early History of the House of Savoy.*

Saw-fish (*Pristis antiquorum*), the type of a special family (Pristidæ) of rays. It attains a length of from 12 to 18 feet, has a long beak or snout, with spines projecting like teeth on both edges, armed with which it is very destructive to shoals of small fishes, and is said to attack the large cetaceans or whales.

Saw-flies, insects of the family Tenthredinidæ and the order Hymenoptera. The ovipositor of the female is composed of two broad plates, with serrated edges, by means of which they incise the stems and leaves of plants, and deposit their eggs in the slits thus formed. The turnip-fly (*Athalia spinarum*) and the gooseberry-fly (*Nematus ribesii*) are examples.

Saws. See *Tools.*

Saxe (sâks), **Hermann Maurice, Comte de**, Marshal of France, natural son of Augustus II, King of Poland, by Aurora, Countess of Königsmark, born 1696, died 1750. At the age of twelve he joined the allied army under the Duke of Marlborough and the Prince Eugène, and was present at the sieges of Lille and Tournay. On the death of his father he joined the French, with whom he distinguished himself at Dettingen and Philipsburg, and in 1744 was rewarded with the *bâton* of a marshal of France. In 1745 he gained the famous battle of Fontenoy. In 1747 he was victorious at Laufeldt, and in the following year took Maestricht, soon after which the Peace of Aix-la-Chapelle was concluded.

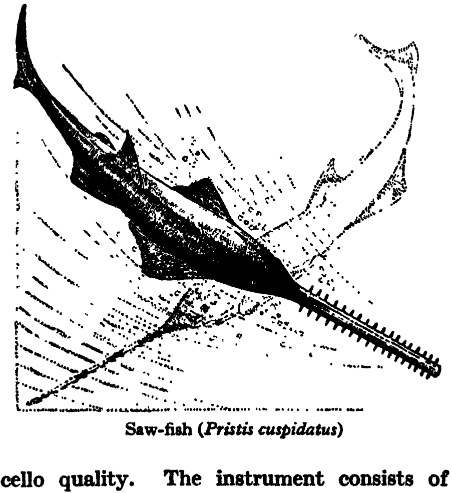
Saxe-Altenburg. See *Thuringia.*

Saxe-Coburg-Gotha, a former sovereign duchy of Germany, and a constituent member of the German Empire, divided since the European War between the Republics of Thuringia and Bavaria.[1] It comprised the Duchies of Saxe-Coburg (area, 217 sq. miles) and Saxe-Gotha (area, 546 sq. miles), with a combined pop. of (1918) 257,200. There were also eight detached portions

Saxe-Meiningen. See *Thuringia.*

Saxe-Weimar. See *Thuringia.*

Saxhorn and Saxophone. Antoine Joseph Sax, commonly known as Adolphe Sax (1814–94), invented (1840) the saxophones, an entire family of brass instruments with a new quality of tone resembling a combination of clarinet and 'cello quality. The instrument consists of a conical brass tube, pierced with holes which are covered and controlled by means of the usual elaborate mechanism, and has a clarinet mouthpiece and a single beating-reed.



Saw-fish (*Pristis cuspidatus*)

In 1845 Sax patented the saxhorn, a new

---

[1] See these articles. Coburg joined Bavaria, and Gotha elected to merge with Thuringia.

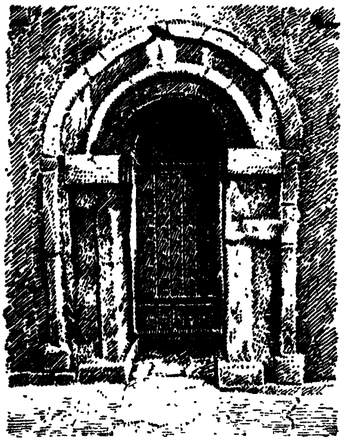
kind of bugle furnished with pistons. It is commonly built in seven pitches, alternately in E flat and B flat, as in the case of the saxophone. The use of the saxhorns is almost entirely confined to military bands, though the lowest members of the family are in use as tubas in the modern full orchestra. Owing to their powerful and slightly aggressive tone-quality, it is not probable that saxhorns will ever replace the more amenable trumpets, horns, and trombones as companions for the stringed instruments.

Sax'ifrage, a popular name of various plants, the saxifrages proper belonging to the genus Saxifrăga, of the nat. ord. Saxifragaceæ. The species are mostly inhabitants of alpine and subalpine regions of the northern zone. Most of them are true rock plants, with tufted foliage and panicles of white, yellow, or red flowers; and many are well known as ornamental plants in our gardens, as *S. umbrōsa,* London pride or none-so-pretty; *S. granulāta,* white or granulated meadow saxifrage; *S. hypnoides,* mossy saxifrage or ladies' cushion; *S. crassifolia,* or thick-leaved saxifrage; *S. sarmentōsa,* or Chinese saxifrage. The genus is a large one, containing upwards of 200 species, of which at least twelve are natives of Britain.

Saxifraga Oppositifolia

Saxo Grammaticus (that is, Saxo the Grammarian), the most celebrated of the old Danish historians, who flourished in the twelfth century (about 1150–1220). He compiled (in Latin) an elaborate history of Denmark down to 1186, *Historia Danica,* which has been translated into English.

Saxon Architecture, the earliest stage of native English architecture, its period being from the conversion of England to Christianity till the Conquest or near it, when Norman architecture began to prevail (seventh to eleventh century). The few relics left us of this style exhibit its rude solidity and strength. The walls are of rough masonry, very thick, without buttresses, and sometimes of herring-bone work; the towers and pillars thick in proportion to height, the former being sometimes not more than three diameters high; the quoins or angle masonry are of hewn stones set alternately on end and horizontally; the arches of doorways and windows are rounded, or sometimes these openings have triangular heads, their jambs of long and short work carrying either rudely carved imposts or capitals with square abaci. Sometimes heavy mouldings run round the arches, and when two or more arches are conjoined in an arcade these are on heavy low shafts formed like balusters. Window openings in the walls splay from both the interior and the exterior, the position of the windows being in the middle of the thickness of the wall.



Saxon Doorway, Earl's Barton, Northampton

Saxons (Ger. *Sachsen,* Lat. *Saxōnes*), a Teutonic race whose name is generally derived from the Old German word *sahs* (a knife or short sword). They are first mentioned by Ptolemy (in the second century A.D), who speaks of them as inhabiting a district bounded by the Eider, the Elbe, and the Trave. In the third century of the Christian era they were a numerous, warlike, and piratical people. In the fifth century considerable hordes of them crossed from the Continent and laid the foundations of the Saxon kingdoms in Britain—Essex or East Saxons, Sussex or South Saxons, &c. (See *England; Anglo-Saxons.*) Those who remained in Germany (Old Saxons) occupied a great extent of country, of vague and varying limits, which bore the general name of Saxony.

Saxony (Ger. *Sachsen*), a Republic of Germany, one of the constituent states of the German Reich. The area and population are made up as follows:

Administrative Division.	Area, sq. Miles.	Pop., 1920.	Pop. per sq. Mile.
Dresden	1675	1,326,270	794·6
Leipzig	1380	1,223,750	888·7
Bautzen	950	433,000	454·3
Zwickau	980	796,560	810·3
Chemnitz	800	890,730	1113·3
Saxony	5785	4,670,310	807·3

Towns.—These include Leipzig, the capital (pop. 605,000), Dresden (590,000), Chemnitz (305,000), Plauen (105,000), Zwickau (70,500), Meissen (38,000), Zittau (36,000), and Bautzen (35,000).

Physiography.—With the exception of South-Eastern Bautzen, which drains to the Oder basin, Saxony belongs to the basin of the Elbe (q.v.), which traverses it for a navigable distance of 71 miles. The Mulde and the Elster are the principal tributaries. The surface, though very much broken, may be regarded as an inclined plane, which commences in the south, in the Erzgebirge chain, and slopes towards the north. In the more elevated districts the scenery is wild, while on either side of the Elbe, from the Bohemian frontier to Pirna, is a remarkable tract, which has received the name of Saxon Switzerland. On the Prussian frontier, where the district subsides to its lowest point, the height above the sea is only 250 feet. The Erzgebirge is continued by the Riesengebirge, a branch of which, under the name of the Lausitzer-gebirge, or Mountains of Lusatia, covers a considerable portion of the east of Saxony.

Productions.—The principal crops are rye, oats, barley, wheat, and potatoes; orchard-fruits, particularly apples, pears, and plums, are abundant; and beet (mainly for cattle-feeding) and flax (in the mountains) are also progressive. The vineyards have suffered greatly from Phylloxera. Apiculture is progressive, and considerable numbers of swine and cattle are raised. Sheep-rearing was once very important, and 'Saxon electoral wool' was considered one of the finest brands in the market. The industry, however, has declined. The minerals include tin, iron, cobalt, copper, nickel, zinc, bismuth, and arsenic; but the mining of argentiferous lead predominates. Numerous seams both of lignite and coal are found, and much coal is exported. Near Meissen a fine porcelain clay exists. Saxony is an important manufacturing country, and, having regard to its size, it may be considered relatively as the busiest industrial state of the German Reich. The principal manufactures are cotton and woollen goods, linen, lace, machinery, musical instruments, clocks, paper, tobacco, sugar, leather and leather goods, porcelain, chocolate, glass, chemicals, and beer. The printing and publishing establishments of Leipzig are well known. Saxony is connected with the great trunk lines which traverse Central Europe, and has over 2000 miles of railway.

Government.—The Constitution of the Republic is dated 26th Oct., 1920, and seven members are sent to the German Imperial Council (*Reichsrat*).

History.—The former royal House of Saxony was among the oldest reigning families of Europe, claiming descent from Widukind, the national hero who was conquered by Charlemagne and embraced Christianity. In 919 Duke Henry of Saxony was elected German Emperor, and his descendants held the title until the death of the Emperor Otto III in 1002. Under Henry the Duchy of Saxony became a material fact. Frederick the Warrior, Margrave of Meissen and Landgrave of Thuringia, became (1423) Elector of Saxony. His grandsons Ernest and Albert in 1485 divided the family possessions, founding the Ernestine (elder) and Albertine (younger) lines respectively. Ernest was succeeded by his sons Friedrich the Wise (1486–1525) and Johann[1] (1525–32), but in 1547 the Elector of the Ernestine line was put under the ban of the empire, and the electorate was transferred to Maurice, representing the Albertine line, which retained the power until the Revolution of 1918.[2] Maurice was succeeded by his brother August (1553–86), who made important additions to the Saxon territories. His son, Christian I, died in 1591, leaving his crown to his son, Christian II, whose brother and successor, Johann Georg I (1611–56), joined Gustavus Adolphus in the Thirty Years' War, and the Saxon forces took part at Breitenfeld and at Lützen. Friedrich August I (1694–1733) embraced the Catholic religion (1697) to obtain the crown of Poland. Friedrich August II also obtained the Polish crown (as Augustus III) after a war with France, and joined with Austria in the Seven Years' War. (See articles under *Augustus II* and *Augustus III.*) Friedrich August III (1763–1827) reluctantly took part against France when war was declared by the Imperial Diet in 1793, but after the battle of Jena the Elector and his army fought side by side with the French. Napoleon conferred upon him the title of king, and large additions were made to the Saxon territory in 1807 and 1809. In 1813 Saxony was the scene of Napoleon's struggle with the allies, and the battles of Lützen, Bautzen, Dresden, and Leipzig were followed by the Congress of Vienna (1815), when a large part of the dominions then under the Saxon monarch was ceded to Prussia. Only the vehement protests of Austria, who regarded Saxony as a suitable buffer state to protect her from her powerful northern neighbour, prevented the complete annexation of Saxony by Prussia. A period of great progress followed, interrupted somewhat by the revolutionary period of 1848–9. In the Austro-Prussian War of 1866 Saxony took part with Austria, and was occupied by the Prussian troops. Prussia again desired to incorporate the kingdom, but the Austrians had the support of France, and Saxony was accordingly left intact but was forced into joining the North German Confederation, and her army was placed under the control of the King of Prussia as the 12th Army Corps. In the Franco-Prussian War Saxony united with the rest of Germany against France. At the outbreak of the European War the reigning monarch was H.M. Friedrich August III.[1] During the war Saxony, an industrial country dependent to a large extent on outside supplies, suffered severely from the prevalent food shortage, and the country rapidly became the stronghold of the German Socialist party. The Revolution of 9th Nov., 1918, culminated in the abdication of the king (13th Nov., 1918) and the formation of a People's Commissaries Cabinet composed of Social Democrats of extremist sympathies and Independent Socialists.

---

[1] Johann "the Steadfast".

[2] The Ernestine line was represented by the ducal families of Saxe-Altenburg, Saxe-Coburg-Gotha, Saxe-Meiningen, and Saxe-Weimar (Grand Duchy).

Say, Jean Baptiste, French economist, born 1767, died 1832. In 1819 he was appointed professor of industrial economy at the Conservatoire des Arts et Métiers, and in 1831 was nominated to the chair of political economy at the Collège de France. His chief works are his *Traité d'économie politique*, *Cours complet d'économie politique pratique*, and *De l'Angleterre et des Anglais*.

Say, Jean Baptiste Léon, French statesman and economist, grandson of Jean Baptiste Say, born 1826, died 1896. He was Minister of Finance, Ambassador at London, and President of the Senate. His works include: *Histoire de la Caisse d'Escompte*, *Les Finances de la France*, and *Les Solutions démocratiques de la question des impôts*.

Sayce, Archibald Henry, Assyriologist and philologist, born 1846. Educated at Bath and Oxford, he became a Fellow of Queen's College in 1869. He was deputy professor of comparative philology at Oxford from 1876 to 1890, and was appointed professor of Assyriology in 1891. His chief works are: *Principles of Comparative Philology*, *Ancient Empires of the East*, *Higher Criticism and the Verdict of the Monuments*, *Egyptian and Babylonian Religion*, and *The Archæology of the Cuneiform Inscriptions*.

Scab, a skin disease in sheep, analogous to itch in man and mange in horses and dogs, usually propagated by contagion, and caused by the presence of minute acari, which burrow under the skin. Various medicines have been recommended, such as lard or palm-oil, 2 lb.; oil of tar, ½ lb.; sulphur, 1 lb., mixed together and rubbed on the diseased spots.

Scabbard-fish, or **Frost-fish** (*Lepidopus caudatus*), a beautiful fish found in the Mediterranean and Eastern Atlantic. It is of a bright silvery white, with a single dorsal fin running along the back. It is the type of a special family (Trichiuridæ) related to that (Scombridæ) containing the tunny and mackerel.

Sca'bious (Scabiōsa), an extensive genus of annual and perennial herbs, belonging to the nat. ord. Dipsacaceæ. They have entire or divided leaves and heads of blue, pink, white, or yellowish flowers. *S. succīsa*, devil's bit, is a common British plant. Sheep's-bit scabious is *Jasione montana*, order Campanulaceæ.

Scad, or **Horse-mackerel** (*Caranx trachūrus*), a genus of teleostean fishes of the family Carangidæ, found in large shoals around the coasts of Britain. The flesh, although coarse, is eaten salted.

Scafell (skä'fel), or **Scaw Fell**, a mountain of England, in the south of the county of Cumberland, near the borders of Westmorland. Of the two peaks the higher (Scafell Pike) is 3210 feet, the other 3162 feet in height.

Scala'ria, a genus of marine, turreted sea-snails, with raised ribs or ridges on their shells. They are found deep in sandy mud, and are commonly called wentle-traps.

Scald-fish, or **Scald-back**, a marine flat-fish (*Arnoglossus laterna*) allied to the turbot, sole, and flounder.

Scale, in music, a succession of notes arranged in the order of pitch, and comprising those sounds which may occur in a piece of music written in a given key. In its simplest form the scale consists of seven steps or degrees counted upward in a regular order from a root or prime (the tonic or key-note), to which series the eighth is added to form the octave. It has been the practice among musicians to consider the scale having C for its key-note as the natural, model, or normal scale. The diatonic scale ascends by five steps (tones) and two half-steps (semitones), taking for the names of the notes the syllables do, re, mi, fa, sol, la, si, do; the two semitones occur between E and F (mi and fa) and B and C (si and do). When the scale is graduated all the way by a series of twelve half-steps or semitones, it is called the chromatic scale. The notes of a pianoforte which lie within the compass of one octave form a chromatic scale, and the pianoforte is said to be tuned on the *equal temperament* system (see Table under *Acoustics*). A scale is said to be major when the interval between the key-note and the third above it, as from C to E, consists of two tones; it is called minor when the interval between the key-note and its third, as from A to C, consists of a tone and a half.

---

[1] The immediate predecessors of Friedrich August were Friedrich August I (1806–27), Anton (1827–36), Friedrich August II (1836–54), Johann (1854–73), Albert (1873–1902), and Georg (1902–4).

Scale-fern, a popular name for a fern of the genus Ceterach (*C. officinārum*), so named from the imbricated tawny scales at the back of the fronds.

Scale-moss, a popular name given to the Jungermannias, plants resembling moss, and belonging to the ord. Hepaticæ.

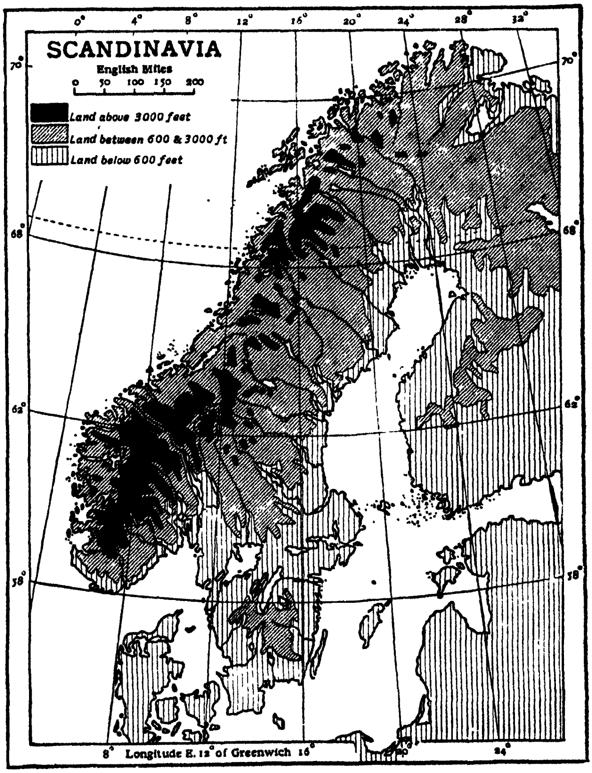
Scales, the over-lapping plates on the exterior of certain animals, as the pangolins or scaly ant-eaters, serpents and other reptiles, and especially fishes. The scales of the latter are developed beneath the true epidermis, and consist of alternate layers of membrane, of horny matter, and occasionally of phosphate of lime. Fishes are sometimes classed, in accordance with the structure of their scales, into Ctenoid, Ganoid, Cycloid, and Placoid (see separate articles). The term scale is applied also in botany to a small rudimentary or vestigial leaf, scale-like in form and often in arrangement, characteristic of underground shoots (rhizomes, bulbs, corms, tubers, &c.), and constituting the covering of the leaf-buds of the deciduous trees in cold climates, the involucre of the Compositæ, the bracts of catkins, &c.

Scaliger (skal'i-jėr), Joseph Justus, French classical scholar, son of Julius Cæsar Scaliger, born at Agen, in France, in 1540, died in 1609. At the age of nineteen he went to Paris, where he studied Greek, Hebrew, Syriac, Persian, and most of the modern European languages. For some time he led an unsettled life, visiting Italy and England in his search for manuscripts. Having become a Protestant, he retired from France after the massacre of St. Bartholomew, and was made professor in the Academy at Geneva, but returned to France in 1574, and lived there for the next twenty years. In 1593 he was appointed to a chair at the University of Leyden, and remained there until his death. Of his numerous works, the treatise *De Emendatione Temporum* is one of the most important. In this work he gave the first complete and scientific chronological system. He wrote annotations to Theocritus, Nonnus, Catullus, Tibullus, Propertius, Seneca (tragedies), Varro, Ausonius, and Festus.—Cf. Sir J. E. Sandys, *A History of Classical Scholarship*.

Scaliger, Julius Cæsar, father of J. J. Scaliger, born in 1484, died in 1558. He resided in Venice or Padua till his forty-second year, occupied with study and the practice of medicine. His writings gave him a high rank among the scholars of his age.

Scam'mony, a plant of the genus Convolvulus, the *C. Scammonia*, which grows abundantly in Syria and Asia Minor. It resembles the common bindweed (*C. arvensis*), but is larger, and has a stout tap-root, from which the drug scammony is extracted. This is a gum-resin, which has a blackish-grey colour, a cheesy smell, and a slightly acrid taste. It is used in medicine as a drastic purge.

Scanderbeg (that is, *Alexander Bey*), prince of Albania, son of John, prince of that country, was born about the year 1404, died 1467. As a boy he was sent as a hostage and educated at the Turkish court. At the age of eighteen, hearing of the death of his father, Scanderbeg renounced Mahommedanism and raised the standard of insurrection in Albania. He repeatedly defeated the Ottoman forces, and Mahommed II found it necessary (1461) to accept terms of peace. After his death Albania again fell under Turkish dominion.



Scandinavia, a peninsular plateau of North-Western Europe, a geographic entity, but divided politically into the two kingdoms of

Norway and Sweden. In a broader sense the term is applied to all the lands occupied by the Scandinavian peoples, viz. Norway, Sweden, Denmark, and Iceland. See *Europe* and *Geography* (section II., *The Surface of the Earth*, sub-section A, *The Lands*).

Scandinavian Languages, a group belonging to the Teutonic branch of the Indo-European family, and represented by the Icelandic, Norwegian, Swedish, and Danish tongues of to-day. These may be traced back to the (probably) common language spoken by the Gothic tribes of Aryan origin, who settled in Scandinavia at, or slightly before, the beginning of the Christian era. The existence of this language (*Norrœna Mal*) is only inferred, and is not distinctly traceable farther back than the ninth century. Until between A.D. 800 and 1000 the Scandinavian language was practically uniform (*Old Norse* or *Dansk*), and is preserved to a greater or less degree in Iceland. The separation into Dano-Swedish and Norwegian-Icelandic branches dates from about A.D. 1000. Modern Swedish has a more archaic Norse character than Danish (which is first met with as a national speech in the sixteenth century). See sections *Language* under countries concerned.

Scandinavian Literature. See *Denmark*; *Edda*; *Iceland*; *Northern Mythology*; *Norway*; *Sweden*; *Saga*.

Scandix, a small genus of plants, nat. ord. Umbelliferæ, annual herbs with striated stems, bipinnate leaves, and small umbels of white flowers. *S. Pecten-Veneris* (needle chervil, shepherd's needle or Venus's comb) is found in Britain.

Scapa Flow, a sea-basin of the Orkney Islands forming a natural harbour almost entirely enclosed by Pomona, Burray, South Ronaldshay, and Hoy, and containing numerous islets. During the European War it served as the base of the British Grand Fleet, and witnessed in Nov., 1918, the surrender of the German High Seas Fleet, and later its scuttling (22nd June, 1919). Rosyth (q.v.) is the peace-time base.

Scape, in botany, an unbranched stem, or rather peduncle, rising from the root and bearing the fructification without leaves, as in the narcissus and hyacinth.

Scap'ula, or Shoulder-blade, the bone which in most mammalia forms the chief bone of the shoulder girdle, and which chiefly supports the upper limb on the trunk or axial skeleton. In man the scapula exists as a flattened bone of triangular shape, which lies on each side of the body, on the back (see plate at article *Anatomy*).

Scarabæ'us, an extensive genus of beetles belonging to a family (Scarabæidæ) embracing some 13,000 species. They are sometimes called *dung-beetles*, from their habit of enclosing their eggs in pellets of dung, which are placed in holes excavated for their reception. The *S. sacer*, or sacred beetle of the Egyptians, was regarded with great veneration; and figures of it were worn as an amulet. Large numbers of these *scarabœi* or scarabs, made of hard stone or gems, are still found in Egypt, often inscribed with hieroglyphics.

Scarborough, a municipal borough, seaport, and watering-place of England, in Yorkshire (North Riding); served by the North-Eastern Railway. It stands on two sandy bays separated by the Scaur peninsula, and called respectively North and South Bay. Between St. Nicholas Cliff and the South Cliff (or connecting the town and the spa) is the Valley Bridge. There is a museum and a castle which crowns the Scaur. Scarborough is much frequented for sea-bathing and for its mineral-waters, the properties of which were known first in 1620. There are two springs, north and south, the first being aperient and the second chalybeate. The spa-house is not frequented so much as formerly. There are an aquarium, two theatres, and a marine drive 4200 feet in length. The harbour of Scarborough is tidal and is dry at low tide, but there is a coasting industry, and fishing is carried on. During the European War Scarborough was shelled on two occasions by German warships, viz. on 16th Dec., 1914, by the *Derfflinger* and *Von der Tann*, when 18 persons were killed and about 110 wounded; and on 4th Sept., 1916, by a submarine, 3 persons being killed. Pop. (1921), 46,192.

Scarlatti, Alessandro, Italian musician, born at Naples 1659, died in 1725. He was educated at Rome under Carissimi, was the creator of modern opera, and wrote much church music.

Scarlet Bean, or Scarlet Runner, a twining plant, the *Phaseŏlus multiflōrus*, a native of Mexico, cultivated as a green vegetable for its long rough pods or as an ornamental plant.

Scarlet Fever, or Scarlatina, is an acute infectious disease, characterized by the appearance of a rash and an inflammatory condition of the throat. It is a disease of temperate regions, and is almost unknown in tropical countries. It is rare in the first year of life, but is found in increasing numbers each year up to the sixth year, and is common from that time until puberty, after which period it is comparatively infrequent. The period of greatest infectivity is during the eruption, or rash, and the infection is conveyed by the discharges from the throat, nose, and ears. At the end of the fourth week most cases are no longer infectious, unless there is still a discharge from the nose or ears. Desquamation (peeling) is now regarded as innocuous unless contaminated by these discharges. The germ which causes the disease has not yet been discovered, but typical scarlet fever has been produced, both in man and monkeys, by inoculation of the mucus from the mouth and throat of a patient. The incubation period is usually two to three days, but may be as short as twenty-four hours, and rarely extends to seven days. The onset is sudden, and the association of the following three symptoms—vomiting, headache, and sore throat—in a child who has previously not been ill is characteristic of scarlet fever. The temperature rises very rapidly, and the pulse becomes quicker than in other acute diseases, while the appearance of the rash on the second or third day makes the diagnosis certain. The rash, which is usually of a diffuse bright-red colour with deeper spots, varies much in intensity according to the severity of the attack, and likewise varies in duration from a few hours to several days. The tongue is at first white with red spots—the papillæ of the tongue—showing through, and later the white fur peels off, leaving a clear red surface. Desquamation varies according to the severity of the rash, and usually starts where the rash first appeared. Though very severe cases occur (toxic and septic scarlet fever), the great majority of cases run a more or less uneventful course, and if care is taken to avoid, or treat, complications, recovery is complete. The common complications are otitis, albuminuria, nephritis, rheumatism, and tonsillitis.

Scarpanto (ancient **Carpathos**), one of the Ægean Islands (Sporadi group), 27 miles long and 6 miles broad. It is mountainous (rising to nearly 4000 feet). It has been under Italian rule since 1912. Pop. about 8000 (mostly Greeks).

Scarron, Paul, French realistic novelist and humorist, born at Paris 1610, died 1660. Before he was thirty he suffered from ailments that left him paralytic and decrepit for the rest of his life. He maintained himself, however, by working for the booksellers. In 1652, when almost wholly paralysed, he married Françoise d'Aubigné, a young girl of considerable beauty, and afterwards known as the famous Madame de Maintenon. Of his numerous writings the best is the *Roman Comique* (1651); and of his plays *Jodelet* (1645) and *Don Japhet d'Arménie* (1653) have considerable literary value.

Scaup Duck, a species of duck, the *Fuligŭla marĭla*. It is common in northern latitudes, and on the British coasts in winter. It feeds on small fish and molluscs, and hence its flesh is coarse.

Scep'ticism, a term applied to those systems of philosophy the predominant attitude of which is doubt, and a disbelief in the possibility of knowledge or man's capacity for it. The Sophists, e.g. Gorgias and Protagoras, were mostly sceptics, but Pyrrho of Elis (360–270 B.C.) was the founder of the first distinct school of philosophic scepticism. This school taught that all contradictions are equally probable; that appearances are neither false nor true; that beauty, justice, and other attributes do not distinguish one thing more than another; and that logical forms are without force. It maintained that the only aim of philosophy is an undisturbed mind, arising from abstinence from judgment. At the beginning of the Christian era scepticism became again an independent movement, and was expounded by Sextus Empiricus (who taught from A.D. 180 to 210). In modern times the founder of the most influential form of scepticism was Hume (q.v.). But just as the scepticism of the Sophists had prepared the way for Socrates and the idealistic system of Plato, so Hume's scepticism paved the way for the Kantian reform.—BIBLIOGRAPHY: A. J. Balfour, *A Defence of Philosophic Doubt*; Janet and Séailles, *History of the Problems of Philosophy*; Zeller, *Stoics, Epicureans and Sceptics*.

Sceptre, a staff serving as the emblem of sovereign power. Some say that it was only a lance without the metal point, to indicate the continuance of supreme power in times of peace. It may, however, also have originated from the simple staff—with many tribes the emblem of old age and wisdom. In the Greek assemblies a person who wished to speak received a sceptre from the herald. By degrees it became the symbol of royal power.

Schaffhausen (shȧf'hou-zn), the most northerly of the Swiss cantons, entirely north of the Rhine, and comprising one main and two smaller portions, all of which are practically enclaves of Baden, excepting upon the southern borders, which march with the Rhine. The main region lies around Schaffhausen, the capital, and comprises the plateau of the Randen (about 3000 feet altitude at its highest point), which slopes towards the Rhine. Agriculture and viticulture are the principal industries, but there are extensive forests and manufactures of tiles. Schaffhausen joined the Swiss Confederation in 1501, and sends two Representatives to the Nationalrat. Area, 114 sq. miles; pop. (1920), 50,430.

Schaffhausen, a city of Switzerland, capital of the canton of Schaffhausen, on the Rhine. It is remarkable for the antique architecture of its houses. The principal buildings are the feudal castle of Unnoth, on a height commanding the town; the parish or St. John's Church; and the minster or cathedral of All Saints, at one time a Benedictine monastery, built between 1052 and 1101. About 3 miles below the town are the Falls of Schaffhausen, by which the whole volume of the Rhine is precipitated over a height of more than 70 feet. Pop. 20,064.

Scharnhorst, Gerhard Johann David von, Prussian general, born in 1755, died in 1818. He had a distinguished career in the Prussian army, was wounded at Auerstädt, and taken prisoner at Lübeck. He was largely responsible for the reorganization of the Prussian army, and in 1813 he accompanied Blücher as lieutenant-general and chief of the staff.

Schaumburg-Lippe, a Republic of Germany, within a loop of the Weser, between Hanover and Westphalia, and belonging mainly to the North German Plain. Agriculture is the main industry, but coal is mined at Bückeburg (pop. 6000), the capital; Stadthagen is the only other town. Area, 131 sq. miles; pop. 46,860.

The Republic was proclaimed in Nov., 1918, and prior to that Schaumburg-Lippe was a sovereign principality, sending a member to the Bundesrat and a Deputy to the Reichstag.

Scheele, Karl Wilhelm, Swedish chemist, born at Stralsund, in Pomerania, then belonging to Sweden, in 1742, died in 1786. He was apprenticed to an apothecary in Göteborg, and after being employed successively in Malmö, Stockholm, and Uppsala, he purchased an apothecary's business in Köping in 1777, and died there. Scheele is one of the greatest names in the history of chemistry. He isolated tartaric acid from cream of tartar, obtained fluosilicic acid from fluor-spar, discovered oxygen (obtained from the black oxide of manganese) independently of and almost simultaneously with Priestley, and discovered also chlorine, baryta, benzoic acid, arseniuretted hydrogen, Scheele's green, sulphuretted hydrogen, molybdic acid, lactic acid, glycerine, tungstic acid, prussic acid, citric acid, malic acid, oxalic acid, gallic acid, &c. His chief published work is *Air and Fire* (1777).

Scheelite, a colourless, translucent mineral with the high specific gravity of 6, consisting of calcium tungstate, and mined with wolfram as a tungsten ore.

Scheffel, Joseph Victor von, German poet and novelist, was born in 1826, and died in 1886. His first literary success was achieved with the epic *Der Trompeter von Säckingen,* which was published in 1854 and went through an enormous number of editions. It was followed by *Ekkehard* (1855), an historical novel almost equally popular; and *Gaudeamus* (1868), a collection of songs in the student vein.

Scheldt (Du. *Schelde,* Fr. *Escaut*), one of the most important rivers of Western Europe, rises in the French department of the Aisne; flows circuitously through Belgium; reaches Ghent, where it receives the Lys; and at Antwerp attains a breadth of about 1600 feet. About 15 miles below Antwerp, shortly after reaching the Dutch frontier, it divides into the East and the West Scheldt (Hondt), thus forming a double estuary separated by a distance of 15 miles. The whole course is 250 miles, of which 207 are navigable.

The 'Question of the Scheldt' arises from the fact that Antwerp (in Belgium) is dependent upon the freedom of the West Scheldt for an exit to the ocean. For the last 40 miles of its course the West Scheldt flows through Dutch territory. In 1863 Belgium bought up the right of the Dutch to levy tolls, so that the navigation of the Scheldt is now free.

Schelling (shel'ing), Friedrich Wilhelm Joseph von, German philosopher, born in 1775, died in 1854. He studied at Tübingen, for a short time also at Leipzig, and from thence proceeded to Jena. His philosophical studies were mainly guided by Fichte, of whom he was first a colleague, and afterwards successor. In 1803 he was appointed professor of philosophy at Würzburg. He lectured at Erlangen from 1820 to 1826, and in 1827 became a professor at Munich, whence he was called to Berlin in 1841. Schelling's system of philosophy was essentially pantheistic, but its later developments are marked by a strong eclectic tendency. The principle of identity—or of one absolute and infinite underlying both nature and spirit, real and ideal, objective and subjective—which he retained throughout, formed a link of connection between the most various systems. Thus Plato (from whom he adopted the world-soul) and the Neo-Platonists, mysticism, Giordano Bruno, the Leibnitzian monads, scholastic realism, and revelation all contributed to his final scheme. Among the writings of Schelling are: *First Sketch of a System of the Philosophy of Nature* (1799), and *System of Transcendental Idealism* (1800).—Bibliography: A. Seth, *The Development from Kant to Hegel*; Kuno Fischer, *History of Philosophy.*

Schenec'tady, a city of New York, United States, the county seat of Schenectady county, on the Mohawk River. Union College, a part of Union University, is in the city. The main works of the General Electric Company are at Schenectady, as are those of the American Locomotive Company. Pop. 88,730.

Scherzo (It. *scherzo,* joke), a piece of music in a playful style, indulging in whimsical surprises and odd turns of phrase, unexpected modulations, &c. The scherzo is a development from the minuet of the early suites, and the minuet and trio of the early symphonies. When Haydn wrote minuets in his symphonies, he was glad of a bright, lively piece of music to follow his slow movements, and never failed to use a quick tempo and a whimsical style of composition. Though these quick minuets were not called scherzos, they were essentially of that type, and undoubtedly stirred Beethoven to compose his scherzo movements.

Scheveningen, a fishing port and much-frequented watering-place of the Netherlands, in the province of South Holland, 2 miles west of The Hague. It stands on sandy dunes. There are boat-building yards, but the great staple of the place is the fishing trade. Pop. 27,500.

Schiedam (*shē*′dâm), a town of the Netherlands, in the province of South Holland, on the Schie (an affluent of the Maas), a junction on the Hook and the Delft-Hague lines. There are hundreds of distilleries employed in the production of Hollands (gin). Pop. 36,000.

Schiller, Johann Christoph Friedrich von, German poet, born 1759, died 1805. He began by studying jurisprudence and medicine. When sixteen years old, he published a translation of part of Virgil's *Æneid* in hexameters in a Suabian periodical, and began an epic, the hero of which was Moses. He still continued his medical studies, however, for in 1780 he wrote an *Essay on the Connection of the Animal and Intellectual Nature of Man*, and in the same year was appointed physician to a regiment in Stuttgart. It was now for the first time that he had enough leisure and freedom to finish his tragedy of *Die Räuber* (The Robbers), begun three years previously. He published this piece at his own expense in 1781; it excited an immense amount of attention, and in 1782 it was performed at Mannheim. In 1783 he settled at Mannheim as poet to the theatre. Here the plays of *Fiesco* and *Cabale und Liebe* were soon after produced. In 1785 he went to Leipzig and Dresden, where he studied the history of Philip II. In this way he prepared himself not only to write his drama of *Don Carlos*, which appeared in 1787, but also to publish a *History of the Revolt of the Netherlands* (1788). Visiting Weimar in 1787, he received a friendly welcome from Wieland, Herder, and Goethe, the latter assisting to procure him (1789) a professorship of philosophy at Jena. Here he lectured on history, and began to publish *Historical Memoirs from the Twelfth Century to the Most Recent Times* (1790); and his *History of the Thirty Years' War* appeared between 1790 and 1793. His first periodical, *Thalia*, begun in 1784 at Mannheim, having ceased in 1793, he formed the plan of publishing a new periodical, *Die Horen* (The Horæ or Hours). It was now also that he returned with renewed ardour to poetry, and produced, particularly after 1795, his finest lyrical poems and ballads. From 1799 he lived in intimate acquaintance with Goethe at Weimar, and published in succession his dramas *Wallenstein*, *Maria Stuart*, *The Maid of Orleans*, *The Bride of Messina*, and *William Tell*. He also adapted Shakespeare's *Macbeth*, Racine's *Phèdre*, &c., for the stage.—BIBLIOGRAPHY: H. Düntzer, *Life of Schiller*; H. W. Nevinson, *Life of Schiller*; Paul Carus, *Friedrich Schiller: Sketch of his Life and Appreciation of his Poetry*.

Schipperke (skip′ėr-ke; 'little skipper'), the Dutch name of a breed of small black dog with a mere stump of a tail. It weighs about 12 lb., and is of Dutch origin (common on canal boats).

Schist (shist), a geological term applied to crystalline rocks which have a foliated structure and split in thin irregular plates, not by regular cleavage, as in the case of clay-slate, nor in laminæ due to simple stratification, as in flagstones. By metamorphism of various rocks, mica-schist, hornblende-schist, chlorite-schist, &c., arise.

Schistostega, a genus of mosses. *S. osmundacea* is the cave-moss, found in caverns and clefts of rocks in Central Europe. The filamentous stage (*protonema*) consists of rounded cells, each constructed like a miniature condensing lens, and hence able to concentrate the feeble light that reaches it upon the chloroplasts. Some of the light is reflected from the back of the cell, and again traverses the chlorophyll on its way out, so that a cave in which this moss is growing, when viewed from outside, appears as if strewn with tiny gems or grains of gold. If the soil or rock is brought into the open, the 'gems' at once become invisible, and it is thought that the familiar tales of fairy gold may be traced to this curious phenomenon.

Schizæaceæ, a small family of leptosporangiate Ferns, section Simplices, natives mostly of tropical America. They are small plants with their sporangia massed on special fertile leaflets. Principal genera: Aneimia, Lygodium.

Schizanthus, a genus of South American herbs, ord. Solanaceæ. *S. pinnatus* and others are favourite greenhouse annuals on account of their graceful foliage and gaudy blossoms.

Schizomycē′tēs, a class of extremely simple plants allied to the Algæ, including those known as bacteria and bacilli. The name, from the Greek *schizō*, to cleave, and *mykēs*, a fungus, has reference to the method of reproduction by fission. See *Bacteria*; *Fermentation*.

Schizop′oda, a tribe of long-tailed crustaceans. They are all of small size and marine. The Mysis (q.v.) is an example.

Schlangenbad, a watering-place of Prussia, in Hesse-Nassau. There are thermal springs, the water of which has a temperature of from 80° to 88° F., and is beneficial in nervous complaints, &c.

Schlegel (shlā′gėl), August Wilhelm von, German critic, poet, and Orientalist, born 1767, died 1845. He wrote poems and ballads, lectured on literature and art, published a tragedy called *Ion*, translated into German the most of Shakespeare's and Calderon's plays, and various works from Sanskrit.

Schlegel, Karl Wilhelm Friedrich von, German literary historian, critic, and writer on æsthetics, brother of the foregoing, born 1772, died 1829. In 1798 he wrote *Lucinde*, an unfinished romance, and *Alarcos*, a tragedy; and lectured as a privat-docent in the University of Jena. Besides the lectures which he published, his chief works are: *History of the Old and New Literature*, *Philosophy of Life*, *Philosophy of History*, and *Philosophy of Language*.

Schleiermacher (shlī′ėr-mȧ*h*-ėr), Friedrich Ernst Daniel, German theologian and philosopher, born 1768, died 1834. He studied at the University of Halle, and became minister in the Charité-Haus (a great hospital) at Berlin. In 1804 he was appointed extraordinary professor of theology at Halle. In 1807 he went to Berlin as pastor of Trinity Church there, and in 1810, when the new university was opened in that city, he was appointed ordinary professor. Schleiermacher was one of the greatest Protestant theologians since the Reformation, but his fame chiefly rests on his philosophical work. He held religion to be based on feeling, and was opposed to insistence on dogmatic forms. The works of Schleiermacher, besides numerous sermons, include: *Outlines of a Critique of Ethics as heretofore taught*, *Christian Belief according to the Fundamental Doctrines of the Evangelical Church*, *Sketch of a System of Morals*, *Philosophical Ethics*, *Dialectics*, and *Æsthetics*.—BIBLIOGRAPHY: A. Dorner, *History of Protestant Theology*; R. Munro, *Schleiermacher*.

Schleswig, the seaport-capital of the Prussian province of Schleswig-Holstein, at the head of the Schlei inlet, an arm of the Baltic. There is a cathedral and a former ducal castle. Tanneries, flour-mills, fishing, and brewing are the chief industries. Pop. 20,000.

Schleswig-Holstein, a province of North-Western Prussia, forming part of the same peninsula with Jutland, to which in its general character it bears considerable resemblance. The Eider is the principal river. The Kaiser-Wilhelm (Kiel) Canal crosses the province. The principal towns are Altona, Kiel, Flensburg, and Schleswig (capital).

Schleswig-Holstein became a united duchy in 1386, and passed to Denmark in 1773. It was appropriated by Prussia (q.v.) after the war of 1866, but was partitioned again by plebiscite after the European War. The plebiscite was held in two zones (Article 109, Treaty of Versailles), North and South. On 10th Feb., 1920, the voting took place in the first zone, and resulted in a great majority for union with Denmark, over 75,000 votes being cast for Denmark, as against 25,300 for Germany. An area of 1537 sq. miles, with an estimated population of 45,396, was thus added to Denmark, and received the Danish title Slesvig (q.v.). In the second zone, polling took place on 14th March, and resulted in an overwhelming win for the Germans, who polled 51,000 votes, against 13,000 cast for Denmark. The area of Schleswig-Holstein is now 5805 sq. miles; pop. 1,462,200.

Schlettstadt (shlet′stȧt), a town of France, in the department of Bas Rhin, on the Ill; served by the railway from Strasbourg to Basel. It was formerly fortified by Vauban, and contains two fine churches of the eleventh and fourteenth centuries, and a fine Gothic gateway. Schlettstadt belonged to France from 1634, but was taken by the Germans in 1870, and restored to France after the European War. Pop. 10,800.

Schliemann (shlē′mȧn), Heinrich, German archæologist, born in 1822, died in 1890. Having established himself in business in St. Petersburg, he travelled widely and acquired many languages, and commenced a series of archæological investigations in the East. In 1869 he published at Paris his *Ithaque*, *Le Péloponnèse*, *Troie: recherches archéologiques*; and in 1874 *Trojanische Alterthümer*, giving the results of his excavations on the plateau of Hissarlik, the alleged site of ancient Troy. In 1875 he commenced excavations at Athens and Mycenæ, and in 1877 discovered the five royal tombs which local tradition in the time of Pausanias asserted to be those of Agamemnon and his companions. Many treasures of gold and silver were brought to light. He received valuable assistance in his investigations from his wife, who was a native of Greece and an accomplished scholar. His *Troja* (1883) and his *Tiryns* (1886) are in a measure supplementary to his earlier works on Troy and Mycenæ.

Schmalkalden, a town of Germany, in the Prussian province of Hesse-Nassau, on the Schmalkalde. It is an antique and picturesque town, with manufactures of iron and steel wares, and there are extensive mines and salt-works in the vicinity. Pop. 10,000.

Schneidemühl, a town of Germany, in the Prussian province of Grenzmark, on the Küddow. There is a considerable trade in farm produce, and glass, machinery, beer, and sugar are manufactured. Pop. 26,000.

Schœnus (skē′nus), a genus of bog plants, nat. ord. Cyperaceæ. The black bog-rush (*Schœnus nigricans*) is the only European species.

Scholas′ticism, the name given to the system of philosophy taught by the philosophers of the Middle Ages, who were called *schoolmen* from the circumstance that their philosophy originated in the schools instituted by Charlemagne for the education of the clergy. The term includes the whole speculative science of the Middle Ages. The great aim of the schoolmen was to reduce the doctrines of the Church to a scientific system, and to construct a theory of the world and of life on a Christian basis. They accepted the truths of Christianity as beyond dispute, and started with the assumption that the creed of the Church was absolutely true. They endeavoured, however, to rationalize dogma. Based as their philosophy was on theology, the criterion of truth and falsehood was not sought in observation and in thought itself, but in the dogmas of the Church. "Scholasticism," wrote Hegel in his *Lectures on the History of Philosophy*, "is not a fixed doctrine, like Platonism or Scepticism, but a very indefinite name which comprehends the philosophic endeavours of Christendom for the greater part of a thousand years."

Scholasticism may be divided into two periods. The first extended from the eighth to the thirteenth century, and is characterized by the adaptation of Aristotelian logic and Neo-Platonic speculations to the doctrine of the Church. This period, which begins with John Scotus Erigena, the real founder of scholasticism, is marked by the controversies which raged between the Nominalists and the Realists, and which terminated at length in the triumph of the latter. The second period of scholasticism, which extends from the thirteenth to the fifteenth century, i.e. the Renaissance, saw both the clear development and extension of scholastic thought and its dissolution. Aristotelian philosophy became more fully known, and exercised an overwhelming influence. The two greatest masters of scholasticism were Thomas Aquinas and Duns Scotus. Other schoolmen were Anselm of Canterbury, Abelard, Peter Lombardus, Bonaventura, Albertus Magnus, and William Durandus. The Reformation gave scholasticism a blow from which it never recovered, although it maintained itself in many universities up to the seventeenth century.—BIBLIOGRAPHY: F. D. Maurice, *Mediæval Philosophy*; W. Turner, *History of Philosophy*.

Scholia, explanations annexed to Greek or Latin authors by the Greek and Latin grammarians (*scholiasts*). There are many scholia to Greek authors extant, fewer to Latin. The names of the scholiasts are mostly unknown. Those, however, of Didymus, John Tzetzes, and Eustathius, the famous scholiast of Homer, have been preserved. The two last belong to the twelfth century.

Schomberg (shom′berg), Friedrich Hermann, Duke of, Marshal of France, was born in 1615, and died in 1690. He began his military career under Frederick, Prince of Orange, and afterwards went to France. He was then employed in Portugal, and was successful in establishing the independence of that kingdom. He commanded the French army in Catalonia in 1672, and was afterwards employed in the Netherlands, where he obliged the Prince of Orange to raise the siege of Maestricht. For these services he was created a marshal of France in 1675; but on the revocation of the Edict of Nantes Marshal Schomberg, who was a Protestant, quitted the French service, and took service under the Elector of Brandenburg. He went to England in 1688 with William III, and after the Revolution was created a duke. He was sent to Ireland in the following year to oppose the partisans of James II, and took Carrickfergus, but was killed at the battle of the Boyne in 1690.

Schools of Composition. The first period of musical composition that was sufficiently organized to deserve the title *school* flourished in Paris, which was the centre of musical development during the twelfth, thirteenth, and part of the fourteenth centuries. The chief musicians of the school were Léonin, Pérotin, Robert de Sabillon, Walter Odington (an Englishman and the earliest writer of note from this country), Jean de Garlande, Franco of Cologne, Jean de Muris, and Guillaume de Machauet. Several of these were organists and 'leaders of discant' at the cathedral of Notre Dame, and all were highly esteemed in their day both as composers and theorists. At its best period the Old French school did much to further the art of composition, and the invention of double counterpoint is very reasonably ascribed to those early masters of Paris.

By the beginning of the fourteenth century the best days of the Old French school were over. The first signs of renewed activity came from an Englishman, John Dunstable (died 1453). Contemporary records go to show that he was regarded in his time as the greatest composer in Europe, and some of his music has been found in cathedral libraries on the Continent. Another Englishman and contemporary, John Hothby, was also highly esteemed; but musical supremacy, after its short stay in England, passed to the Netherlands, where it remained for a century and a half.

The composers of the Netherlands school had been well served by the French and English musical pioneers. One of the earlier members of the school was John Tinctoris (1445–1511). Guillaume Dufay (1391–1474) was the first really representative composer of this school, and also the first to use a secular *cantus firmus* in place of plain song as the basis of composition. He and his immediate followers greatly improved the smoothness and consistency of their counterpoint and developed the use of imitative phrases. This device of 'imitation' took possession of the minds of the succeeding generation of composers and became a kind of craze, which reached its fullest development in Okeghem (died about 1496). This voluminous composer did not mind how ugly his music was so long as it was clever.

He was the teacher of Josquin des Prés (1450–1521), who was a much finer musician and one of the first to show real gifts of expression. His works afford some of the earliest examples of music printing. During the latter part of the fifteenth and the whole of the sixteenth centuries the Netherlands produced an increasing number of great composers, and they nearly all went to Italy, where they were welcomed as the greatest musicians of the time.

The direct result of this systematic invasion was that the lead in music began to pass to Italy, the first representative of the Roman school being Costanzo Festa (1490–1545), who wrote the familiar *Down in a flow'ry vale*. The greatest musician of this school was Orlando di Lasso (1520–94), a composer whose works are full of noble and beautiful qualities. He was a contemporary of Palestrina (1528–94), who was the greatest representative of the Roman contrapuntal school, and the most inspired of all writers in the old pure choral style. The madrigal was the invention of the Netherlands school, which produced many fine specimens, but the form was brought to perfection in Italy, and also, at a slightly later period, in England.

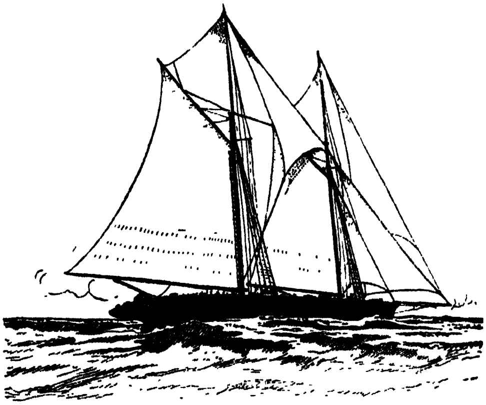
From the beginning of the seventeenth century the cultivation of the art of composition became gradually more and more widespread. At present the various schools do not stand apart from each other as definitely as those that have been discussed. It will be sufficient merely to name the various operatic schools of Italy (all the chief cities had one); the French grand opera school, founded by Lully; the schools of Bach and Gluck; the classical school of instrumental music, perfected by Beethoven; the romantic school, heralded by Weber with Schumann as chief apostle; the Neo-German school, the 'programmists' deriving from Liszt and Wagner; and the 'ultra-modern' school, equally active and equally promising in most countries.

Schooner, a small vessel with two masts, and the principal sails on both of the fore-and-aft type. There are two chief types, the top-sail schooner and the fore-and-aft schooner, the former carrying a square top-sail and top-gallant sail (with sometimes a royal) on the fore-mast, and the latter having fore-and-aft sails alone, or sometimes a square sail on the fore-mast. There are also schooners with three or more masts, carrying fore-and-aft sails on each. A 'jackass schooner' has three masts, the fore-mast like that of a top-sail schooner.

Schopenhauer, Arthur, German philosopher, born 1788, died 1860. He studied at Göttingen, Berlin, and Jena, spent a winter at Weimar with Goethe, and afterwards travelled in Italy. He lectured at Berlin with little success, and spent the latter part of his life in Frankfort. His works include: *On Vision and Colours* (1816), *On the Will in Nature* (1836), *The Two Fundamental Problems in Ethics* (1841), and *Parerga and Paralipomena* (1851). But his greatest work, and that which made him famous, is his *The World as Will and Idea* (first edition, 1819).

The philosophical system of Schopenhauer has for its fundamental doctrine the proposition that the only essential, or thing-in-itself, reality in the universe is *will*. His conception of will, however, has a much wider signification than the common acceptation of the term implies. In it Schopenhauer includes not only conscious desire, but also unconscious instinct, and the forces which manifest themselves in inorganic nature. What are called *appearances* exist only in our subjective representations, and are merely forms under which one universal will manifests itself. Between this universal will and the individuals in which it appears there are a number of ideas, which are stages in the objectivization of the will. Throughout nature, from the lower animals downwards, the will works unconsciously, and it only attains consciousness in the higher stages of being, as man.

All intelligence serves originally *the will to live*. In genius it is emancipated from this servile position, and gains the preponderance. Upon this foundation Schopenhauer rears his æsthetical and ethical structures; the former of which derives much from the Platonic system, while the latter, in maintaining the necessity of entirely subduing the sensuous nature in man, without determining positively the true end of spiritual life, resembles the Buddhistic doctrine of Nirvana, or of the fortunate final state of saints who have been purified by asceticism, and have entered into the unconscious state. The will, both in nature and in ourselves, is irrational, and whilst engendering dissatisfaction and a life



Fore-and-aft Schooner

of suffering, offers no hope for things becoming better. Only when *the will to live* is killed by asceticism, when we renounce our desires and strivings, can we escape from the misery of the world and find refuge in æsthetic contemplation. —BIBLIOGRAPHY: H. Zimmern, *Arthur Schopenhauer: his Life and his Philosophy*; W. Caldwell, *Schopenhauer's System in its Philosophical Significance*; J. Sully, *Pessimism: a History and a Criticism.*

Schubert (shö′bert), Franz, Austrian composer, born at Vienna in 1797, died in 1828. He commenced his musical education in his seventh year, and in 1808 was admitted among the choristers of the court chapel. He soon acquired particular efficiency on the piano and the different stringed instruments, so that in a short time he was able to take the part of first violin in the orchestra. After he left the court chapel he supported himself by teaching music, devoting himself in obscurity and neglect to original composition. He achieved success in almost all kinds of music, but his genius was specially noteworthy for its opulence in melody and lyric power. His songs and ballads, as exemplified in his three principal collections, the *Winterreise* (1826–7), the *Müllerlieder* (1828), and the *Schwanengesang* (1828), may be said to have revolutionized the *Lied* in making the accompaniment not less interpretative of the emotions of the poem than the vocal part, and in breaking through the limitations of the old strophic method. Besides his six hundred songs he left about four hundred other compositions, including fifteen operas, six Masses, and several symphonies. Two only of the operas, *Rosamond* and *The Enchanted Harp*, were performed during his life, and they are considered inferior to his unproduced *Fierabras*. His symphonies take a higher rank, the Seventh (in C major) being ranked by Mendelssohn and Schumann with Beethoven's. His entire work justifies Liszt's description of him as the most poetic of musicians.

Schumann (shö′màn), Robert Alexander, German composer, was born in 1810, and died in 1856. He was at first destined for the law, but after overcoming parental opposition abandoned it and, on the advice of Friedrich Wieck, began the serious study of music. He practised the pianoforte too assiduously, and in an excess of zeal for technical mastery permanently injured his right hand. This made it necessary for him to abandon all thought of playing, and turned his mind to composition and writing on music. In 1832 he first met Clara Wieck, the daughter of his teacher, and married her eight years later. As Clara Schumann she added to her existing fame as a great pianist, and was the means of familiarizing her husband's compositions. The marriage was a particularly happy one, though destined to be of short duration. In 1843 the first symptoms appeared of that mental malady which was the ultimate cause of Schumann's death, and from that date until his death there were several alternations of lucid and clouded periods. The disease reached its climax in 1854, when the composer threw himself into the Rhine. He was rescued by some boatmen and conveyed to an asylum, where he passed the remaining two years of his life.

Schumann takes rank among the great composers by virtue of the beauty, the rhythmic vitality, and, above all, by the originality of his music. He left works of permanent value in orchestral music, chamber music, and particularly in songs and compositions for the piano. As a critic of music he was unrivalled for his powers of sympathetic insight. In 1834 he founded the *Neue Zeitschrift für Musik*, and acted as editor for ten years. His contributions have been collected into one volume.

Schuylkill (skōl′kil), a river of the United States, in Pennsylvania, which rises in the north side of the Blue Mountains, runs south-east, passes through the confines of Philadelphia, and unites with the Delaware 7 miles below that city. It is 140 miles in length.

Schwäbisch-Hall, or simply **Hall**, a town of Württemberg, Germany, in the Kocher valley, on the Heilbronn-Krailsheim line of the State Railways. There are important salt-works and cattle marts, and saline springs are found nearby. Pop. 10,000.

Schwarz (shvàrts), Berthold, German monk, born in the first half of the fourteenth century, a Franciscan friar of Germany, formerly regarded as the inventor of gunpowder and fire-arms. The invention of gunpowder, however, is probably at least as old as the time of Roger Bacon (died 1292), but Schwarz may perhaps be credited with the invention of field-artillery. In 1380 he was commissioned by the Venetian Government to cast some cannons. The price agreed upon not being forthcoming, he became importunate, and was thrown into prison, where it is believed he died in 1384.

Schwarzburg-Rudolstadt. See *Thuringia.*

Schwarzburg-Sondershausen. See *Thuringia.*

Schwarzenberg, Felix Ludwig Johann Friedrich, Prince of, Austrian statesman, born 1800, died 1852. He entered the army in 1818, but turned to diplomacy, and in 1848 was called to be the head of the new Government. His great object was to govern Austria as a single state in a military and absolute manner—still not without some inclination to internal reforms; and to establish the preponderance of the Austrian power in Germany and Central Europe;

and this, after the suppression of the Hungarian revolt, he largely succeeded in doing.

Schwarzenberg, Karl Philipp, Prince of, Austrian soldier, born at Vienna in 1771, died in 1820. He served in the early wars of the French Revolution, taking part in the battles of Würzburg, Ulm, Austerlitz, and Wagram. He negotiated the marriage between Napoleon and Maria Louisa. In the campaign of 1812 he commanded the Austrian auxiliary corps in Galicia. After Napoleon's return from Elba he commanded the allied forces on the Upper Rhine.

Schweidnitz (shvīt′nits), a town of Germany, in the Prussian province of Silesia, on the Weistritz, at the foot of the Riesengebirge. Its manufactures include machinery, woollens, linens, furniture, earthenware, carriages, gloves, paper, bottles, needles, nuts and screws, and beer. It is the centre of a district containing a large number of small manufacturing towns, whose varied activities include iron-smelting, glass- and pottery-making, linen- and cotton-weaving, coal-mining, and the manufacture of chemicals. Pop. 31,000.

Schweinfurt (shvīn′fu̧rt), a town of Bavaria, on the Main. It was long a free imperial city, and has a town-house of 1570, and a gymnasium founded by Gustavus Adolphus. The manufactures include Schweinfurt green, vinegar, beer, sugar, flour, machinery, soap, cotton, and bells. Pop. 23,000.

Schwerin, a town of the Republic of Mecklenburg-Schwerin, the republican capital, on the Lake of Schwerin. It has a fine old Gothic cathedral (thirteenth to fifteenth centuries). The manufactures consist of machinery, carriages, woollen and linen cloth, lacquer, and earthenware. Pop. 45,460.

Schwyz (shvēts), a central canton of Switzerland; area, 351 sq. miles. It belongs to the so-called forest cantons (Waldstätter), and is generally hilly. The whole canton belongs to the basin of the Rhine, less than two-thirds of the surface being drained by the Sihl and the Lake of Zürich; a third by the Lake of Lucerne, chiefly by means of the Muota; and the remainder by the Lake of Zug. The chief industry is essentially pastoral, cattle being raised on the abundant Alps or mountain pastures. There are few minerals, and none of economic value, while manufactures are almost confined to some cotton and silk spinning and weaving, the latter being an important cottage industry.

Schwyz was the most important of the cantons which first threw off the yoke of Austria, and gave the name to the whole confederation. Schwyz is the capital, but Einsiedeln is the largest town. The great body of the inhabitants are German-speaking Roman Catholics. Pop. (1920), 59,731.

Schwyz, a town of Switzerland, capital of the canton of Schwyz, at the foot of the Gross Mythen (6250 feet). Its port is Brunnen, on the Lake of Lucerne. Pop. 9000.

Sciacca, a seaport of Sicily, in the province of Girgenti. Near by are the saline springs of Monte San Calogero (ancient *Mons Cronius*), known to the Romans as *Aquæ Larodes.* Pop. 25,000.

Sciæ′na, a genus of spiny-finned teleostean fishes, forming the type of a family—the Sciænidæ, allied to the sea-perches. The most important of the genus is the *S. aquila*, the *maigre* of the French, whose chief habitat is the Mediterranean.

Sciat′ica, a term used in medicine to denote a rheumatic affection, in which the pain stretches along the course of the great sciatic nerve, that is, from the hip along the back part of the thigh towards the ham of the leg. There is stiffness and pain, increased by any change of temperature and moisture, and by any movement increasing the tension on the nerve. Secondary sciatica may be caused by pelvic disease or by disease of the hip-joint.

Scilly Islands (sil′i), a group of granitic islands belonging to England, forming part of the county of Cornwall, at the entrance to the English Channel, about 30 miles west by south of Land's End. They are granite outliers of the highlands of Cornwall, and rise steeply from the sea, forming a compact group about 30 miles in circumference. Only six of the islands are of any importance, the remainder (about a hundred and forty in number) being mere rocks and islets. These six are St. Mary's, St. Agnes, St. Martin's, Tresco, Bryher, and Samson. Samson is uninhabited. Hugh Town, on St. Mary's, is the capital, and has regular steamship communication with Penzance, and telegraphic and telephonic connection with the mainland. Owing to the mildness of the climate (46° F. in winter, 50° F. in summer) even palms will flourish. There is some fishing, and lobsters are sent to London. Area, 6 sq. miles; pop. 1,750.

To the Greeks the Scillies are said to have been known as the *Cassiterides* (q.v.), but this is improbable. In the tenth century they were annexed to the English Crown, and were given by Athelstan to some monks who were settled on Tresco; Henry I transferred them to Tavistock Abbey. They next passed into private hands, but were purchased by Queen Elizabeth and annexed to the Duchy of Cornwall.

Scintillation, the term applied to the twinkling motion of the light of the fixed stars. This phenomenon is not observable in planets, except occasionally when they are near the horizon. Scintillation is due to the earth's atmosphere.

A star is so far off that it is virtually a luminous point, and hence sends us a very slender pencil of light, which is affected by the variations of density, &c., in our atmosphere, and by refraction is given the appearance of twinkling. Planets, on the other hand, are near enough to appear as discs, and hence send out a pencil of numerous rays which converge upon the retina. The number of these rays will make their average effect nearly constant. The longer the path of the rays through the earth's atmosphere the greater is the tendency to scintillate. As the planet Mercury has a very small apparent disc, and is only to be seen at a low altitude, it twinkles considerably.

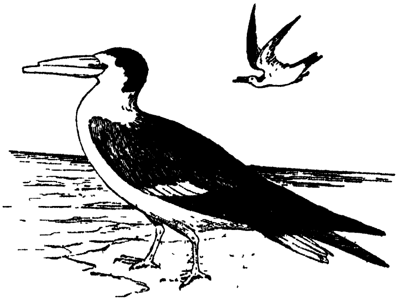
Scio. See *Chios.*

Scio'to, a river of Ohio, United States. Its general course is south, its length about 220 miles, and it flows into the Ohio River between Portsmouth and Alexandria. It is navigable for about 130 miles.

Scip'io Africa'nus, The Elder, Publius Cornelius Scipio Africanus Major, Roman general, was born about 237 B.C., died about 183 B.C. In 210 he took the command of the Roman army in Spain, destroyed the Carthaginian power, and saved Rome. The Carthaginians recalled Hannibal from Italy, but the great battle of Zama, fought 19th Oct., 202 B.C., resulted in the total defeat of the Carthaginians, who, on the advice of Hannibal, sought for peace. On his return to Rome Scipio was honoured with a triumph, and received the surname of *Africanus.* After this he discharged, in a praiseworthy manner, the office of censor; but lost the favour alike of the old Roman party and the new. After the successful close of the war with Antiochus, King of Syria, in 189 B.C., Scipio retired into private life. He died in his villa at Liternum, in the same year as his opponent Hannibal.

Scipio Africanus, The Younger, Publius Cornelius Scipio Æmilianus Africanus Minor, son of L. Æmilius Paullus, the conqueror of Macedonia, and adopted son of P. Cornelius Scipio, the son of Scipio Africanus Major, born about 187 B.C., died in 129 B.C. In 152 B.C. he accompanied the consul Lucius Licinius Lucullus to Spain as military tribune, and in 149 B.C., on the outbreak of the third Punic War, commanded in Africa under the consul M. Manlius Nepos. His services were so important that in 147 B.C., contrary to the usual custom, not being of the legal age, he was unanimously chosen consul and leader of the forces against the Carthaginians. In 146 B.C. he took, and by command of the Senate burned Carthage, for which he was honoured with a triumph at Rome and with the surname of *Africanus.* In 142 B.C. he was elected censor, and in 134 B.C. entered on his second consulship, in order to put an end to the war with Numantia in Spain. For his conquest of this powerful city a triumph was decreed to Scipio, and he received the surname of *Numantīnus.* He soon, however, became very unpopular, on account of his opposition to the agrarian laws of Tiberius Gracchus. He was found dead in his bed, having probably been murdered by Carbo.

Scissor-bill, or **Skimmer** (Rhynchops), a genus of Laridæ or gulls, so named from the possession of an elongated beak of compressed form, the lower mandible exceeding the upper one in length, and shutting into the latter somewhat after the fashion that the blade of a knife does into its handle. It is used for scooping up water and mud to secure small animals as food. There are five species, one (*R. nigra*) native to the eastern part of the United States, two to South America, one to Africa, and one to South Asia.


Scissor-bill or Skimmer (*Rhynchops nigra*)

Scitamineæ, a common name often used to include several closely allied natural orders of monocotyledons, viz. the Musaceæ (bananas), Marantaceæ (arrow-roots), Cannaceæ (Indian-shot family), and Zingiberaceæ (gingers).

Sclerotinia, a large genus of ascomycetous Fungi, group Discomycetes, closely related to Peziza, but distinguished by producing, at one stage of the life-history, a solid tuberous hibernating structure called a *sclerotium*; from this later the cup-shaped ascus-fruits (*apothecia*) arise. Several species are important or interesting parasites. *S. sclerotiorum* attacks and kills potato, French bean, turnip and swede, cucumber, &c.; *S. trifoliorum* destroys clover, lucerne, and sainfoin; and *S. Fuckeliana* (especially in the conidial stage known as *Botrytis cinerea*—see *Botrytis*) causes damage to the vine and many other plants. *S. Vaccinii* infects the berries of cow-berry and other species of Vaccinium. Its conidia emit a strong scent of almonds, and are carried by insects to Vaccinium flowers; if deposited on the stigma, they produce hyphæ, which grow down the style into the ovary just like pollen-tubes, the result being the formation of a sclerotium in place of the normal berry.

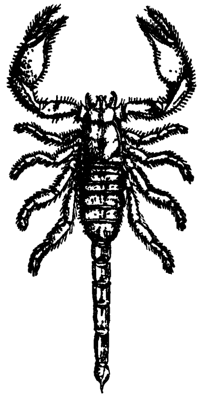
Scolopac′inæ, the sub-family of birds to which the snipe and woodcock belong. It is a subdivision of the plover family (Charadriidæ).

Scone (skōn), a village of Perthshire, Scotland. The parish comprises New Scone and Old Scone, the former being a modern village of 2800 inhabitants. In the eighth century Scone was the capital of Pictavia, one of the four kingdoms into which modern Scotland was then divided. Under Kenneth Forteviot became the capital of the kingdom, but Scone was the keeping-place of the Stone of Destiny. See *Coronation Chair.*

Scopas, a famous Greek sculptor working under the influence of the Doric school, who flourished in the first half of the fourth century B.C. He executed much of the sculpture for the temple of Athena Alea at Tegea, and part of those on the Mausoleum at Halicarnassus, of which some parts are in the British Museum. The well-known *Demeter* of Cnidos may be an original by Scopas, and shows the emotional intensity which marks his work. The *Niobe* group, sometimes attributed to him, may be by Praxiteles, or of later date.

Scoresby, William, British Arctic explorer, born at Cropton, in Yorkshire, 1789, died in 1857. He made his first voyages with his father, and in 1811 he was appointed to succeed him as captain of the *Resolution.* Through information communicated by him to Sir Joseph Banks, the Government was induced in 1817 to fit out an expedition under Sir John Ross to discover the north-west passage. In 1820 Captain Scoresby published a work entitled *An Account of the Arctic Regions, with a History and Description of the Northern Whale-fishery,* which established his reputation as one of the most original observers and scientific navigators of the day. In 1825 he took holy orders, and was afterwards vicar of Bradford. He wrote several treatises on magnetism, dealing especially with its relation to navigation.

Scorpion, the name of animals of the class Arachnida (which includes also the spiders, ticks, and mites), order Scorpionidea, the largest of their class, save the marine king-crabs (Xiphosura). Scorpions have an elongated body, and a long slender tail formed of six joints, the last of which terminates in a curved, sharply pointed sting, which effuses a poisonous liquid. This sting gives rise to excruciating pain, usually without redness or swelling, except in the glands of the arm-pit or groin. It is very seldom, if ever, fatal to man. The animal has four pairs of walking-legs borne by the thorax or chest-segments. The head carries a pair of small nippers (cheliceræ), and a pair of large pincers, with which the prey—chiefly insects and spiders—is seized, to be afterwards killed by the sting. Breathing is effected by four pairs of lung-books opening on the under side of the abdomen. There are from six to twelve simple eyes on the upper side of the carapace. Scorpions generally live in dark places, and under stones. They are found in the south of Europe, in Africa, in the East Indies, and in South America. The scorpions are first represented in a fossil condition in the Silurian period. The book scorpions (Cheliferidæ) are so named from their close outward resemblance to the true scorpions. The book scorpions are, however, of minute size, and are included in another order (Chernetidea) of the class Arachnida, whilst they want the jointed tail of the true scorpions. They are generally found living amongst old books.



Scorpion

Scorpion-fish, or **Sea-scorpion** (Scorpæna), a genus of carnivorous spiny-finned teleostean fishes, family Scorpænidæ. The spines of one of its dorsal fins are provided with poison-glands. These fishes are found in most seas, some of them at great depths.

Scorpion-fly (Panorpa), a genus of insects of the order Neuroptera, or net-wings. The male in the common species (*P. communis*) has the last few joints of the abdomen attenuated, and capable of extensive motion. When at rest this tail is curled over the back.

Scorpion-shell, or **Spider-shell**, the name given to the shells of certain sea-snails of the family Strombidæ, from the projecting spines on the shells. They are chiefly found in the Indian and Chinese Seas.

Scorzone′ra, a genus of plants of the nat. ord. Compositæ, sub-ord. Cichoraceæ, with yellow or rose-coloured flowers. The species, which are numerous, are chiefly indigenous to Southern Europe and the East. The common Scorzonera (*S. Hispanica*), a native of Spain and the south of Europe, has long been cultivated in English kitchen-gardens for its edible roots.

Scot, Reginald or Reynold, English writer against the belief in witchcraft, alchemy, astrology, and other prevalent superstitions of his time, born about 1538, died 1599. The work on which his reputation is founded is entitled *The Discoverie of Witchcraft,* and was published in 1584. By order of James I the first edition of the book was burned by the common hangman, and the king replied to it in his *Demonology.* Refutations were also published by Meric Casaubon, Joseph Glanvil, and others.

Scoter, or Surf Duck (Oedemia), a genus of sea-ducks. The most familiar species is the common or black scoter (*O. nigra*). The upper mandible is marked on its dorsal surface by a line of orange colour. The scoter occurs in the Arctic regions in summer, but comes southwards to the British coasts in winter; also to the Azores and Mediterranean.

Scotland, Kingdom of, geographically, the northernmost portion of the Island of Great Britain, comprising the mainland and the adjacent islands (or Hebrides, including the Orkney and Shetland groups, Lewis and Harris, and St. Kilda).

Area and Population.—

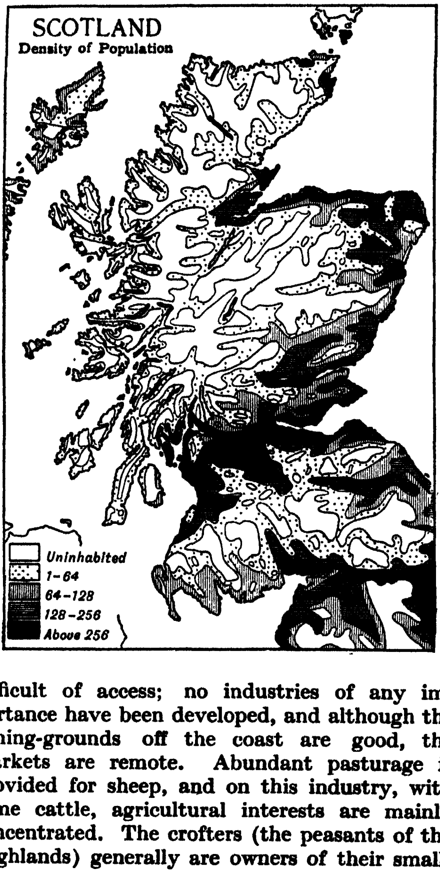
	County.	Area in Statute Acres.	Population, 1911.	Population, 1921.
1	Aberdeen	1,261,521	312,177	300,980
2	Argyll	1,990,472	70,902	76,856
3	Ayr	724,523	268,337	299,254
4	Banff	403,053	61,402	57,293
5	Berwick	292,535	29,643	28,395
6	Bute	139,658	18,186	33,711
7	Caithness	438,833	32,010	28,284
8	Clackmannan	34,927	31,121	32,543
9	Dumbarton	157,433	136,233	150,868
10	Dumfries	686,302	78,825	75,365
11	East Lothian (Haddington)	170,971	43,254	47,487
12	Fife	322,844	267,733	292,902
13	Forfar	559,037	281,417	270,950
14	Inverness	2,695,094	87,272	82,446
15	Kincardine	244,482	41,008	41,779
16	Kinross	52,410	7,527	7 963
17	Kirkcudbright	575,832	38,367	37,156
18	Lanark	562.821	1,486,118	1,539,307
19	Midlothian (Edinburgh)	234,325	507,666	506 378
20	Moray (Elgin)	304,931	43,427	41,561
21	Nairn	104,252	9,319	8,790
22	Orkney	240,847	25,897	24,109
23	Peebles	222,240	15,258	15,330
24	Perth	1,595,802	124,342	125,515
25	Renfrew	153,332	279,066	298,887
26	Ross and Cromarty	1,977,248	77,364	70,790
27	Roxburgh	426,028	47,192	41,989
28	Selkirk	170,793	24.601	22,606
29	Shetland	352,319	27,911	25,520
30	Stirling	288,842	160,991	161,726
31	Sutherland	1,297,914	20,179	17,800
32	West Lothian (Linlithgow)	76,861	80,161	83,966
33	Wigtown	311,984	31,998	30,782
	SCOTLAND	**19,070,466**	**4,760,904**	**4,882,288**

See the articles under counties, towns, rivers, islands and lochs, &c.

Physical.—There are three main divisions: (1) Highlands, (2) Midland Valley, and (8) Southern Uplands.

(1) *Highlands.*—The Highlands lie north of the Highland Boundary Fault, which extends in a north-easterly direction from Dumbarton to Stonehaven, and are subdivided into a northern and a southern region by Glenmore (Great Glen), which is occupied by Lochs Ness, Oich, and Lochy; these are connected to form the Caledonian Canal. The highest part of the Highlands extends between Ben Nevis (4400 feet) and Ben Macdhui (4800 feet), and the main drainage radiates from this district: the Garry and the Tummel, tributaries of the Tay, run south, the Findhorn and Spey north-east to the Moray Firth, the Spean west to Loch Linnhe, and the Dee east to the North Sea. Along the coast there are many remarkable fjords (Lochs Long and Goil, Fyne, Linnhe, and the Moray Firth), and lakes of surpassing beauty are found in Lochs Awe, Tay, Ericht, Maree, Shiel, Lomond, and Katrine. The Islands of Skye and Mull, and some smaller islands separated from the mainland by drowned river valleys, are of basaltic structure; Staffa is famous for the natural erection of columnar basalt known as Fingal's Cave; the Outer Hebrides are, like the Lofodens of the Norwegian coast, wind-swept, treeless islands with bare, worn-down, rounded hills. *Economic.*—Relatively, the Highlands are poor, but the shooting and trout- and salmon-fishing attract many visitors, and towns are usually devoted to catering for tourists and to fishing. Whisky-distilling is an important industry, in which Campbeltown is prominent. The soil is poor and the rainfall heavy; agriculture does not flourish, and the land is largely devoted to deer forests. (These are not wooded areas but open, treeless moors.) In recent years all these factors have contributed to the rapid depopulation of the Scottish Highlands; they have been unable to maintain their population in face of the competition of other

areas of the kingdom which can afford modern standards of comfort, and where the conditions of life are somewhat easier. There is no coal, but the abundant water-power of the innumerable burns and streams may yet be utilized for the provision of hydro-electric power. Internal communication is slow, and transport is costly; development is hindered by the rugged, hilly, inhospitable nature of the country, which is difficult of access; no industries of any importance have been developed, and although the fishing-grounds off the coast are good, the markets are remote. Abundant pasturage is provided for sheep, and on this industry, with some cattle, agricultural interests are mainly concentrated. The crofters (the peasants of the Highlands) generally are owners of their small-holdings. They raise sheep and grow small quantities of oats and potatoes. Great quarries of grey granite exist at Aberdeen, and at Peterhead red granite is worked.

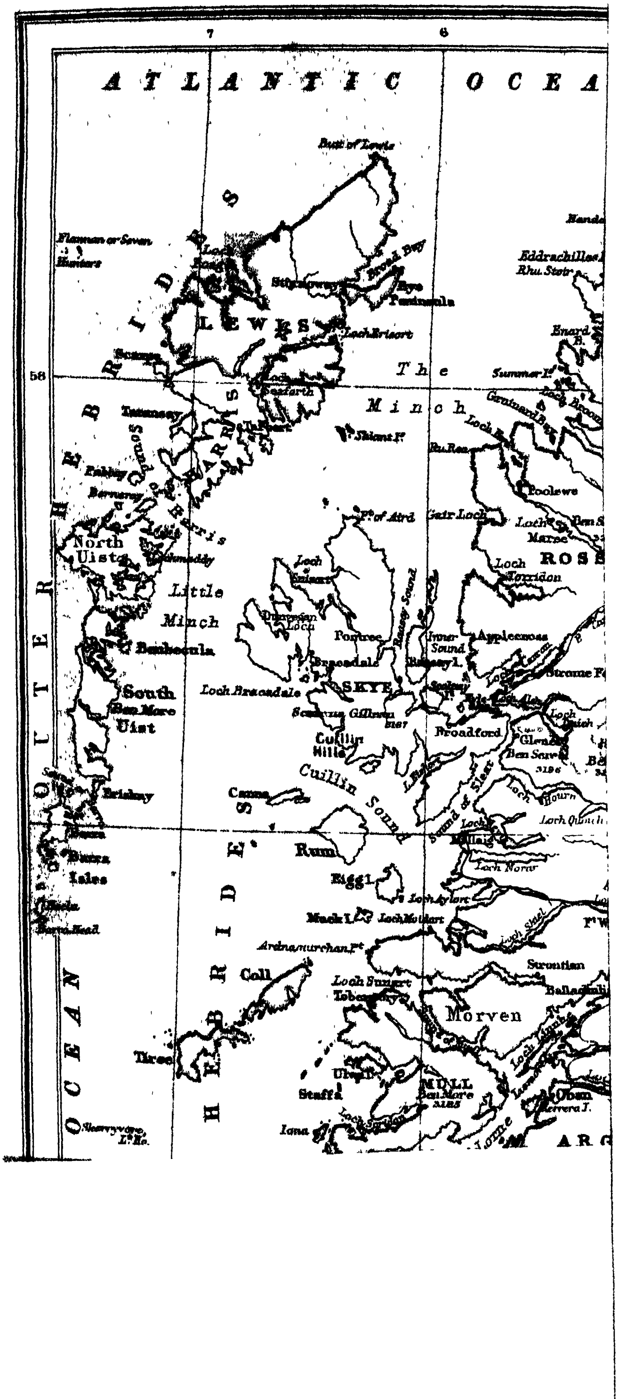


The Scottish Highlands are the oldest part of the British Isles; they represent a fragment of the ancient continent of *Arctis*, which extended from Scandinavia, through Scotland, to eastern North America, and included Greenland and the lost land of which Iceland forms a vestige. The Highlands region is a dissected plateau, and the 'mountains' are residual mountains, formed by the carving out of the softer rocks by rivers and other agents of denudation.

(2) *The Midland Valley.*—Extending between the Highland Boundary Fault and the line of faulting running from Girvan north-eastwards to Dunbar (the Southern Boundary Fault) lies a rift-valley, 50 miles wide, comprising marginal areas of Old Red Sandstone, and a central region of Carboniferous Limestone with rich stores of coal, iron ores, and oil-shales, which give to the valley its importance as the industrial and the wealthiest and most densely populated area of all Scotland. The hills include the Sidlaw and Ochil Hills and Campsie Fells in the north, and the Pentland and Lanarkshire Hills in the south. The denuded stumps, or necks, of old volcanoes are prominent, such as Ailsa Craig, Dumbarton Rock, Edinburgh Castle Rock, the Bass Rock, and North Berwick Law. *Economic.*—The chief coal-fields are in Lanarkshire, Ayrshire, and in Fife, beside the Firth of Forth. The Fife coal-field feeds the linen industry of Fife, which centres around Dunfermline, and the linoleum industry of Kirkcaldy, which (with Burntisland) is the outlet of the Fife coal area. In Lanarkshire the coal-fields were the most easily worked, and as a consequence they were more quickly developed. Glasgow, the seat of the greatest shipbuilding industry in the world, was originally a bridge-town, but the deepening of the Clyde enabled ocean-going steamers to reach it, and the exploitation of the mineral wealth of Lanarkshire, and the development of the New World, have made it the second city of the empire. Ardrossan, Troon, and Ayr are outlets for the Ayrshire coal-field. (See *Paisley*; *Greenock*; *Port-Glasgow*; *Dumbarton*; &c.) The iron industry of the west of Scotland is largely maintained by the import of ores from Spain and Algeria; the local deposits are practically exhausted. There are large chemical and metallurgical industries. Bathgate is the centre of paraffin distillation from shale, and Airdrie, Coatbridge, Hamilton, Wishaw, and Falkirk are iron-smelting localities. Edinburgh (with Leith, as port) is the capital of Scotland, and is considered one of the finest cities of Europe.

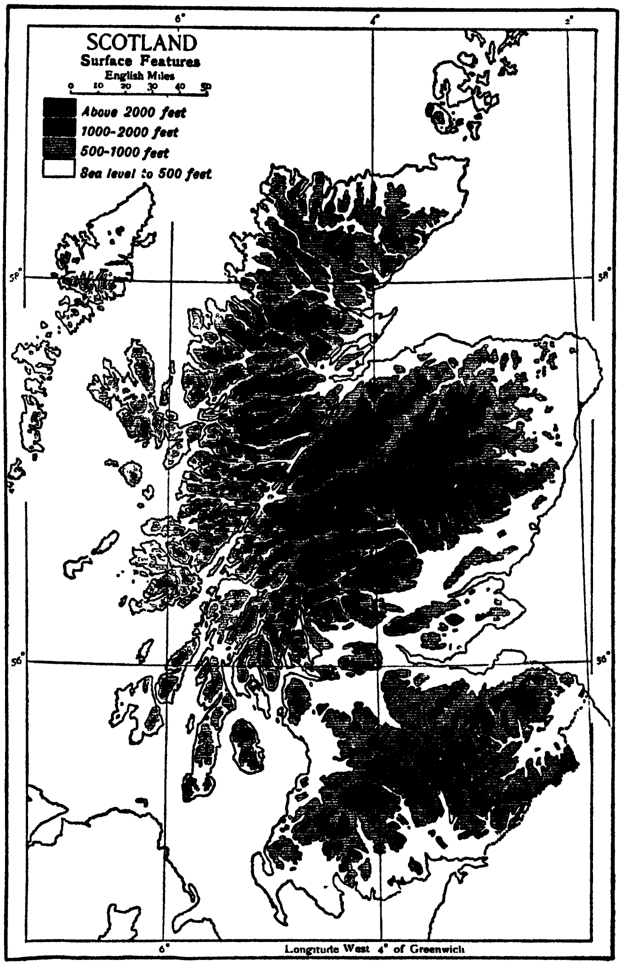
(3) *Southern Uplands.*—This region rises steeply from the Midland Valley, and extends southwards to the line of the Cheviots and the Solway Firth. It is a broken plateau of rounded, grassy hills, furrowed by river valleys, but there are lowland regions in the south and south-east. The Southern Uplands average 1000 feet in altitude, and are lower than the Highlands. *Economic.*—They form one vast sheep-run, which has given rise to the famous woollen industries of Dumfries, Peebles, Galashiels, Selkirk, Jedburgh, Hawick, and the Tweed Basin generally. In the centre rise the Clyde, Tweed, Annan, and Nith. Galloway and lower Ayrshire are noted for cattle and dairy produce.

The isolated character of the Highland valleys led to the maintenance of the clan system and of a patriotic spirit, which found expression in a


7
6
58
ATLANTIC OCEA
Butt of Lewis
Flannan or Seven Hunters
Broad Bay
Stornoway
Eye Peninsula
LEWIS
Loch Erisort
Scarpa
The Minch
Loch Seaforth
Taransay
HARRIS
Shiant Is.
Sound of Harris
Pabbay
Berneray
North Uist
Lochmaddy
Little Minch
Benbecula
South Uist
Ben More
Eriskay
Barra
Barra Isles
Barra Head
OUTER HEBRIDES
OCEAN
Pt. of Aird
Loch Snizort
Dunvegan Loch
Portree
Raasay Sound
Inner Sound
Raasay I.
Bracadale
Loch Bracadale
SKYE
Cuillin Hills
Broadford
Cuillin Sound
Sound of Sleat
Canna
Rum
Eigg I.
Muck I.
HEBRIDES
Loch Ailort
Loch Moidart
Ardnamurchan Pt.
Coll
Tiree
Loch Sunart
Tobermory
Morven
Strontian
MULL
Ben More 3185
Ulva
Staffa
Iona
Oban
Kerrera I.
Skerryvore Lt. Ho.
Handa
Eddrachilles B.
Rhu Stoir
Enard B.
Summer Is.
Loch Broom
Gruinard Bay
Loch Ewe
Ru Rea
Poolewe
Gair Loch
Loch Maree
Loch Torridon
ROSS
Applecross
Loch Carron
Strome Ferry
Loch Alsh
Loch Duich
Glenelg
Ben Screel 3196
Loch Hourn
Loch Quoich
Loch Nevis
Mallaig
Loch Shiel
Ft. W
Ballachulish
Loch Linnhe
Loch Etive
Loch Scridain
ARG

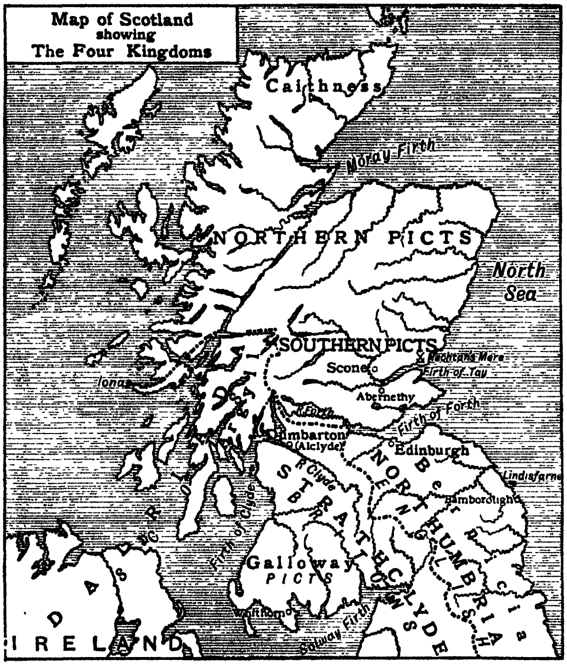
long continued loyalty to the House of Stewart. The moorland characteristics of the Southern Uplands have caused a certain sparseness in population; this cut the Anglo-Saxon kings off from the control of the Lothians, and so led to their abandonment to the Scottish Crown.

Political Constitution. — The Parliament of Scotland anciently comprised all who held any portion of land, however small, from the Crown by tenure of military service, till the reign of James VI, when the small barons or freeholders were excused from attendance in person, 'two or more wise men' being deputed from each county in proportion to its size. Its powers were nominally extensive, but the supreme power was virtually in the king, who by his influence often entirely controlled its proceedings. The Parliament in the whole consisted of three estates—the nobility, the clergy (consisting of bishops, abbots, and priors), and the lesser barons, or representatives of shires and burghs. When Presbyterianism was formally ratified by law after the Revolution of 1688, the ecclesiastical estate ceased to have a place in Parliament. Every measure brought before Parliament was previously prepared by a committee, styled the Lords of the Articles, chosen from each of the three orders, but in effect little better than royal nominees. Before the Union there were four great officers of state—the Lord High Chancellor, the High Treasurer, the Lord Privy Seal, and the Secretary; and there were also four lesser officers—the Lord Clerk Register, the Lord Advocate, the Treasurer-Depute, and the Justice-Clerk. Previously to the era of the Revolution the Privy Council of Scotland assumed inquisitorial powers, and even torture was administered under the sanction of its authority. The number of peers in the Scottish Parliament was eventually 160, and of commons 155, and all sat in one House, and voted promiscuously. At the union of the kingdoms the political system of Scotland was almost entirely incorporated with that of England. See *Britain, Parliament.*



History: (1) *The Period of Formation.*—The Kingdom of Scotland, in the historical sense, did not come into existence until the eleventh century. Our earliest information belongs to the period of the Roman invasions, and Roman writers distinguish between two races of inhabitants. The population south of the line of the Forth and Clyde was Brythonic or British, and was allied in blood to the Welsh and to the Continental Gauls, whom Cæsar called Celts. The tribes who lived farther north were known to the Romans as Caledonians and to the Britons as the people of Albion. The Caledonians or Albans were later distinguished into Goidels (or Gaels) and Picts. The Gaels were of a similar stock to the British, and, since the eighteenth century, British and Gaels have alike been termed 'Celtic'. This usage originated in the discovery of an affinity between the language of

Britanny and those of the Welsh and the Scottish Highlanders, and it has become universal. It is, however, necessary to distinguish between the Brythonic Celts of Wales, Cambria, and Strathclyde, and the Goidelic Celts or Gaels of the Northern Highlands. The identity of the Picts is one of the standing puzzles of Scottish history, and the controversy is familiar in the opening chapters of Scott's *Antiquary*. Many guesses have been made, and it has even been surmised that the Picts were non-Aryan, but the orthodox theory is that of W. F. Skene, who argued that they were Goidelic Celts, and that their language was Gaelic. They certainly spoke Gaelic in historical times, but, at an early date, there was sufficient difference between the speech of Picts and Gaels to attract the attention of contemporary observers, and St. Columba found it necessary to employ an interpreter in Pict-land. (See section *Ethnology*.)

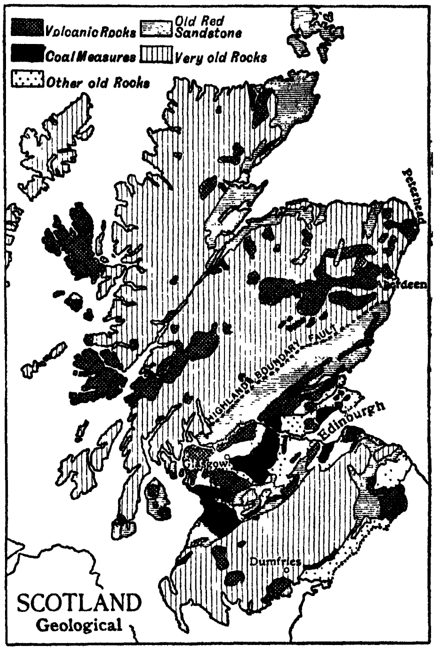

Map of Scotland
showing
The Four Kingdoms

Two invasions of North Britain took place in the end of the fifth and the middle of the sixth century. Somewhere about A.D. 500 a body of Goidelic Celts, known as Scots, crossed from Ireland and founded the Kingdom of Dalriada or Scotland, the area of which corresponded roughly with the modern county of Argyll. About 547 the Anglian king, Ida, founded the Kingdom of Bernicia, which extended from the Tees to the Firth of Forth, and expelled the British from the south-east of modern Scotland, the district known historically as Lothian. The amalgamation of the four peoples, British, Scots, Picts, and Angles, into one kingdom was a very slow process. The foundation of the ultimate union of Scots and Picts was laid by the missionary labours of St. Columba. Coming from Ireland in 563 to the already Christian kingdom of Dalriada, he was given the Island of Iona as a centre for his missionary work, and he and his followers Christianized Pict-land. The Christian religion had long before been introduced among the British of Strathclyde, and also among a tribe of Picts who lived in Galloway, where St. Ninian laboured in the end of the fourth century, and a Christian revival, under St. Kentigern, was contemporary with the mission of Columba. The work of Columba and his followers was done chiefly in Pict-land and among the Angles of Lothian. The Columban missionaries in Lothian were expelled after the victory of Roman Christianity at the Synod of Whitby (664), but they created a link between Scots and Picts until, in 710, Nectan, King of the Picts, accepted the Roman usages. His successor, Angus macFergus (731–761), the greatest of the Pictish monarchs, ravaged and subdued Dalriada, and its fortunes are obscure until the middle of the ninth century, when the menace of the Scandinavians led to the union of Scots and Picts. The Northmen began to make their raids about 794, and about 835 these raiders began to develop permanent settlements along the coasts and in the western islands. The actual occasion of the union of Picts and Scots (844) was a Scandinavian attack upon Pict-land, for Kenneth macAlpin, King of the Scots (i.e. of Dalriada), seized the opportunity of Pictish weakness to establish his rule over the Picts. It was not, however, a mere conquest, for Kenneth macAlpin had claims by maternal descent (which were recognized by the Picts) to the Pictish throne, and the influence of religion had again become a force in favour of unity, for, since the seizure of Iona by the Northmen, Dunkeld had become the ecclesiastical centre of both kingdoms.

The amalgamation of Lothian and of Strathclyde with Alban (the kingdom of Picts and Scots) was delayed for two centuries. The British kingdom, attacked by Angles, by Picts, and by Northmen, was generally in practical dependence upon one or other of its neighbours, and in 1018 Duncan, a grandson of Malcolm II, King of Alban, became King of Strathclyde, and on his accession to Alban in 1034 united both kingdoms. The Angles of Lothian retained their separate existence, as part of an English kingdom, until the same period. During the greatness of the Kingdom of Northumbria in the seventh century, the Angles threatened the independence of the Picts until in 685 Ecgfrith of Northumbria was defeated at Nectansmere (Dunnichen, in Forfarshire), a battle which proved the death-blow of Northumbrian greatness. After the union of the Picts and Scots, the English and the Scots of Alban were alike occupied in resisting the Northmen, and they once or twice acted in concert, but the consolidation of England under the successors of Alfred the Great roused alarm, and in 937 Constantine III of Alban allied with the Danes in an attack upon the English, but was defeated by Athelstan at Brunanburh, the site of which is uncertain. Successive monarchs of Alban tried to add Lothian to their dominions, but it was not until 1018 that Malcolm II won, at Carham, near Coldstream, a battle which led to its annexation. His successor, the Duncan of Shakespeare's *Macbeth*, united the whole of the historical Kingdom of Scotland in 1034, but his reign of six years was unfortunate, and he was slain in battle by his own general, Macbeth, who, through his wife, had a claim to the throne. Macbeth was probably in alliance with an independent Scandinavian chief, Thorfinn, who ruled in Caithness, Sutherland, and the Orkneys, and his power lasted until Thorfinn's death in 1057. In that year Macbeth was defeated and slain at Lumphanan, in Aberdeenshire, by Duncan's son Malcolm, who had been living in exile in England.

Shakespeare's *Macbeth* is apt to give an entirely erroneous impression of both Duncan and Macbeth. Duncan was actually a young man at the time of his death, and Macbeth, as a king, was vigorous, strong, merciful and just, and is the first Scottish king to appear in ecclesiastical records as a patron of the church.

(2) *The Period of Consolidation.*—The reign of Malcolm III (Canmore, i.e. 'Big-head') marks the beginning of a new era in Scottish history. The kingdom was now geographically homogeneous, although the actual boundary-line between Scotland and England was not settled until the lapse of another century, but it was not organized, and the central power was very weak. The next two centuries saw the development of a system of administration, civil and ecclesiastical, based on Anglo-Norman models. This development followed the marriage of Malcolm III to the Saxon princess Margaret, who had fled from England after the Norman Conquest. During Malcolm's reign Scotland continued to be a Celtic kingdom, but the queen introduced English manners and customs, and she initiated great changes in the Scottish Church which, though not in any way antagonistic to the Papacy, was entirely out of touch with it, followed its own customs and usages, and was practically unorganized. There was only one bishop of the Scots, and his authority must have been confined to the region near St. Andrews, which had become the ecclesiastical capital. The reforms actually effected by Queen Margaret were slight, but her work was continued by her sons. After Malcolm's death in 1093 there was a Celtic reaction, but during the reigns of Margaret's three sons, Edgar (1097–1107), Alexander I (1107–24), and David I (1124–53) (q.v.), all of whom were Anglo-Norman in sympathies and interests, Scotland adopted English manners and institutions, and the English language spread from Lothian into other districts.



SCOTLAND
Geological

The anglicization of Scotland was the result of three main causes. In the first place, the court became Anglo-Norman, the administration of the country came to be conducted by officials similar to those who administered the Kingdom of England, a new code of law was gradually evolved on English models, and the land system was reorganized in accordance with the principles of English feudalism. Large tracts of land were given to members of great Anglo-Norman families, and the nobility of Scotland became Anglo-Norman in blood, or in manners and customs. In the second place, the Church was organized on the English model and brought into intimate relations with Rome by the division of the country into dioceses, and most of the early bishops were Englishmen. The old Scottish order of monks, the Culdees, was gradually suppressed, and the recognized monastic orders were introduced, and were so richly endowed by David I that his successor, James I, afterwards described him as " ane sair sanct for the Crown ". But the object of David was not entirely religious, for the new monks were Englishmen, and were used as pioneers of Anglo-Norman civilization in Celtic Scotland. In the third place, the growth of trade and the rise of burghs founded on English models brought English merchants to settle in the towns and spread the English tongue. This Anglo-Norman conquest of civilization and language continued through the reigns of the successors of David I—Malcolm IV (1153–65), William the Lion (1165–1214), Alexander II (1214–49), and Alexander III (1249–86). It met with violent opposition from the Celtic population, especially in Moray and Galloway, and from the death of Malcolm III to the end of the reign of Alexander II there was a series of revolts, some of which were difficult to suppress. But the centralization of authority in the hands of a succession of able and vigorous monarchs ultimately gave complete victory to the policy of the dynasty of Malcolm Canmore, and in the reign of Alexander III the royal power was acknowledged even in the districts of Ross, Argyll, and Galloway. The Western Islands, which had been long under Norwegian rule, were recovered after the battle of Largs (1263).

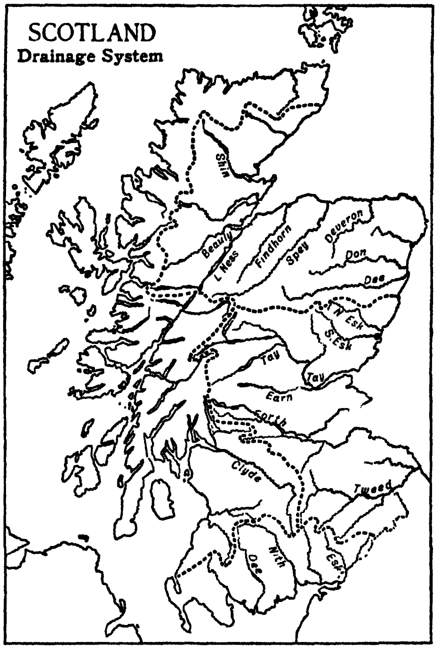
By Western Islands is meant all the Hebridean islands except Orkney and Shetland. These were known in Norse as the *Sudreys* and the name lives to-day in *Sodor* (diocese of *Sodor and Man*).

Anglo-Scottish Relations.—Great importance attaches to Anglo-Scottish relations during this period. The process of anglicization was conducted by monarchs who, in spite of their English sympathies, were determined to maintain the independence of their kingdom. Attempts by the sees of Canterbury and York to assert supremacy over the Scottish Church were successfully resisted, and in 1188 a Papal decision was obtained that the Church in Scotland owed obedience only to Rome. This decision was followed in 1225 by permission to hold a Provincial Council annually. The political relations between the two countries were complicated by the circumstance that the kings of Scots, from Malcolm III to Alexander III, possessed lands in England, for which they did homage to the English sovereign. The homage so rendered was thus ambiguous, and the importance of the question was increased by the marriage of David I to the heiress of the earldoms of Huntingdon and Northumbria. Only the former claim was admitted, and the ambition of obtaining possession of Northumberland determined the policy of David I and William the Lion. David's intervention in the English Civil War in the reign of Stephen gave him a temporary hold of Northumberland, but the accession of Henry II put an end to this tenure, and it was in an effort to recover it that William the Lion invaded England in 1174 and was made prisoner. By the Treaty of Falaise he was compelled to acknowledge English supremacy over the Kingdom of Scotland, but this agreement was cancelled by a bargain made with Richard I in 1189, and the Scottish kings continued to do a homage which was capable of more than one interpretation.

(3) *The War of Independence, 1286–1343.*—A new importance began to attach to the question of homage when Alexander III died in 1286, leaving as his heiress an infant grand-daughter Margaret, the Maid of Norway. Her accession was endangered by the ambition of the Anglo-Scottish families of Balliol and Bruce, both of which were related to the Crown, and the Scots welcomed a proposal of Edward I of England to marry the child queen to his eldest son. The relations between the two countries had long been peaceful and friendly, and Scotland, which was becoming united and prosperous, was glad to escape the danger of civil war. An agreement was made at Birgham in 1289, but the Maid of Norway died in the following year, and Edward I then put forward a claim to the overlordship of the kingdom, and asserted his right, as Lord Paramount, to decide among the rival candidates for the throne. He decided in favour of John Balliol, who, by the rule of primogeniture, stood nearer the throne than Robert Bruce. From 1292 to 1296 Balliol governed Scotland as a vassal-king. He found his position ignominious, and, making an alliance with France, he repudiated the English overlordship, whereupon Edward invaded Scotland (1296), captured Berwick-on-Tweed (where he was guilty of a massacre), defeated a Scottish army at Dunbar, received the surrender of Balliol, and overran Scotland. He claimed the kingdom as the forfeited property of a contumacious vassal, destroyed or removed many of the records, carried off the Stone of Destiny or Coronation Stone (see *Scone*), and left Scotland under English military occupation. So far he had been dealing with the Anglo-Norman nobility of Scotland, and the people, deserted by their natural leaders, had been unable to resist; but in 1297 they found a leader in Sir William Wallace (q.v.), who, as the commander of 'the Army of the Commons of Scotland', completely defeated the English

at Stirling Bridge, and during 1297–8 was Guardian of Scotland. Edward in person defeated Wallace at Falkirk in 1298, but fresh Guardians were elected, and the struggle continued until 1304–5, when Edward, whose attention had been distracted by domestic difficulties and a French war, seemed to have subdued Scotland. A renewal of hostilities was not long delayed. In Feb., 1306, Robert Bruce, the grandson of the original claimant of that name, and John Comyn, who represented the Balliol claim, met at Dumfries to adjust their rival pretensions, obviously with a view to fresh resistance. In the course of an angry discussion Bruce stabbed Comyn, who was immediately dispatched by Bruce's followers. The murder compelled Bruce to raise the standard of resistance almost immediately, and in unfortunate circumstances, for Comyn had been killed in a church, and the new leader was excommunicated. He was hastily crowned, and was defeated at Methven in June. Until the spring of 1307 he was a hunted fugitive, but a victory at Loudon Hill on 10th May was the turning-point in his career, and on 7th July Edward I died near Carlisle. The weakness and inaction of Edward II enabled Bruce to defeat his Scottish enemies, the partisans of the murdered Comyn, and with the help of the Black Douglas to recapture the castles and strongholds held by English garrisons. At Bannockburn, on 24th June, 1314, he completely defeated Edward II in person, and from that day the independence of Scotland was safe. Its safety was due not only to the leadership of Wallace and Bruce, but also to the determination of the people of Scotland that the country should be free. The absolute independence of Scotland was acknowledged in the Treaty of Northampton (1328). Within four years it was again in jeopardy. Bruce died in 1329, and his heir, David II (1329–71), was a boy. Edward III of England was ambitious of restoring the military reputation of England; there were disputes about the execution of the treaty, and in Aug., 1332, an English army, sent to place Edward (son of John) Balliol on the throne as a vassal king, defeated the Scots at Dupplin. The position of Edward Balliol soon became impossible, and he fled to England in December, but the war continued; the English obtained possession of the whole of the south of Scotland, and Edward III marched as far north as Elgin. The assertion of a claim to the French throne, however, diverted the activities of the English king, and the Scots by 1343 had recovered the greater part of the lost territory, and had brought back David II from exile in France. This period may be taken as the close of the War of Independence, for the freedom of the country was never again in grave danger.

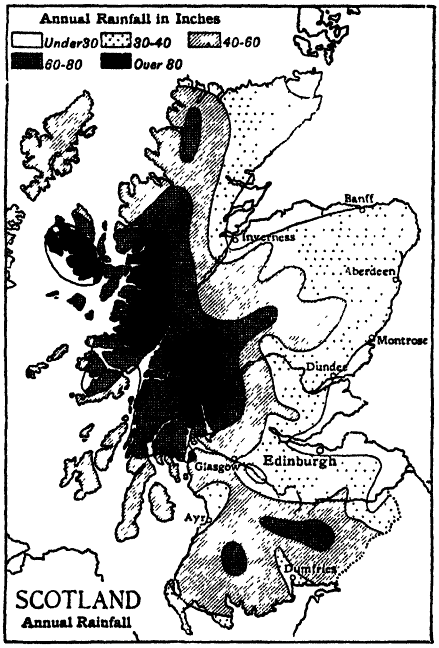
(4) *The Franco-Scottish Alliance.*—John Balliol's original defiance of Edward I had been made in reliance on French help, but the French gave no assistance in the time of Wallace, and they deserted Bruce entirely. The ambition of Edward III, however, drove Scotland and France into an active partnership; the French helped the Scots in the struggle which began in 1332, and the Scots, declining an English offer to restore all Scottish territory in their hands, made common cause with the French. This decision was repeated on several later occasions, and Scotland was involved in the various phases of the Hundred Years' War. The first Scottish intervention on behalf of France led to a defeat at Neville's Cross, near Durham, in 1346, and the capture of David II, who, on his release, tried in vain to persuade the Scots to desert France and to accept a son of Edward III as heir to the throne. David was succeeded by his nephew, Robert II (1371–90), son of Robert Bruce's daughter Marjory, who had married the High Steward of Scotland. He was the first king of the House of Stewart. Robert II and his son, Robert III (1390–1406), were feeble old kings, and their reigns were marked by internal disorders as well as by the usual conflicts with England. The eldest son of Robert III (the Duke of Rothesay) died mysteriously in 1402, and his brother James was captured by the English on



his way to France. The first years of his reign (1406–37) were spent in captivity. His uncle, the Duke of Albany, was Regent of Scotland, and the regency was memorable for the foundation of the University of St. Andrews and for the suppression of a rebellion of Donald of the Isles at Harlaw. When James was released after the death of Henry V, he had a hard task in reducing the country to order. His reign, however, witnessed the most important decade of the Franco-Scottish alliance (1421–31), when Scottish troops took a great part in the initial stages of the French recovery from the conquest of Henry V. James was murdered by discontented nobles in 1437, but his policy (after a troubled minority) was continued by James II (1437–60). The events of the War of Independence and the forfeiture of partisans of the English cause had led to the rise of noble families whose power constituted a menace to the Crown. The greatest of these families, the House of Douglas, was suppressed by James II (q.v.), and the royal authority was greatly increased. Meanwhile, the recovery of lands held by the English was progressing. In 1460 James was killed while besieging Roxburgh, which (apart from Berwick-on-Tweed) was the only Scottish stronghold held by the English, but the castle was taken immediately after his death. In the minority of his son, James III (1460–88), Scottish intervention in the Wars of the Roses culminated in the temporary restoration of Berwick, and through the young king's marriage with Margaret of Denmark, Orkney and Shetland were at last added to Scotland. A reign which began hopefully was ruined by quarrels in the royal family and by the jealousy shown towards the king's favourites by the nobility, and James met his death in a rebellion. (See *James III.*) The reign of his son, James IV (1488–1513) was the Golden Age of mediæval Scotland. There was great commercial prosperity, and James built a Scottish navy. In 1503 he married Margaret, daughter of Henry VII of England, and an English alliance promised a period of peace. The real object of the Franco-Scottish League had been achieved when the English were driven out of France and Scotland (about 1460), but after the accession of Henry VIII, James espoused the French cause and was defeated and killed at Flodden (Sept., 1513). (See *James IV.*) The influence of the Queen Mother might have renewed the English alliance, but she was fickle and treacherous, and although the Regent (the Duke of Albany), whom the French party in Scotland brought from France, was incompetent, relations with England were not improved in the minority of James V (1513–42). When James came to manhood, his uncle, Henry VIII, invited him to throw off the Roman allegiance, but James refused and made two French marriages, the second with Mary of Guise. Ultimately the two countries drifted into war, and James died broken-hearted after the defeat of Solway Moss (1542). (See *James V.*) His French policy was unpopular in Scotland, partly owing to the rising influence of Protestantism, and Henry VIII was able to negotiate a marriage agreement between his son Edward and the infant Queen Mary (1542–67). But Henry's folly and impatience led to the rupture of the agreement, and Scotland was invaded by English armies under the Earl of Hertford, who, as Protector Somerset, won (Sept., 1547), at Pinkie, the last of the old battles between Scots and English, but failed to detach Scotland from the French alliance. In 1548 the little queen was sent to France to be married to the dauphin. Her mother, Mary of Guise, became Regent (1554), and the French alliance seemed to be secure, but the rapid growth of Protestantism produced a rebellion, aimed at the influence of France as well as at the authority of the Pope. The death of the Regent (June, 1560) marks the end of the 'Auld Alliance', which, besides being of great political value between 1330 and 1460, had profoundly affected the civilization, manners, and institutions of the Scots. The influence of England, which had been dominant before the War of Independence, was replaced by that of France in the fourteenth, fifteenth, and sixteenth centuries until the Reformation produced a new approximation to English ideals and customs.

(5) *The Religious Struggles.*—After the Regent's death a Scottish Parliament proscribed the Roman Church and made Protestantism the established form of faith. Queen Mary returned from France, as the widow of Francis II (1561), and had to accept the fact of the Reformation. Any attempt to restore Roman Catholicism was impossible, both because of the violence of Protestant feeling in Scotland and because Mary's great aim was to be recognized as heir presumptive to the English throne. Her marriage with her cousin Henry, Lord Darnley, his murder in Feb., 1567, and Mary's marriage to the Earl of Bothwell (known to be one of Darnley's murderers), led to her fall and to the succession of her infant son, James VI (1567–1625). Mary, who was imprisoned in Lochleven Castle, escaped in May, 1568, but was defeated by her half-brother, the Regent Murray, at Langside, and fled to England, where she was kept as a prisoner until her execution in 1587. Under a series of Regents, the first three of whom were occupied with the suppression of the Queen's party, the Protestant Church acquired great political power. After the death of its first great leader, John Knox (q.v.), in 1572, the Scottish Church, under the influence of Andrew Melville (q.v.), became

Presbyterian in organization, though titular bishops continued to receive the revenues of the old dioceses. When James VI (q.v.) came of age, he set himself to give an episcopal constitution to the Church, believing that episcopacy was best suited to monarchical government. There was a long and fierce struggle, but James had won a considerable victory before his accession to the English throne (1603). That event very greatly increased the royal authority in Scotland, and James was able not only to make the Crown supreme over the Parliament and the Privy Council, but also to nominate General Assemblies of the Church, which accepted an episcopal constitution. The great change which he made was to replace the General Assembly by bishops, as the supreme governing body of the Church; but he left undisturbed the local church courts, and did not interfere to any serious extent with Presbyterian forms of worship. His son, Charles I (1625–49), after alienating the nobility by securing a modest provision for the clergy out of forfeited ecclesiastical revenues, attempted to make the Church of Scotland uniform in government and ritual with that of England. The introduction of a new Prayer Book (1637) precipitated an Edinburgh riot, which was the beginning of a revolution. The National Covenant to resist innovations in religion was signed in 1638, and was followed by the Bishops' Wars. Charles tried to temporize, but the development of his difficulties in England led him to visit Scotland (1641) and to yield to all demands. His ideal of compulsory uniformity was adopted by his opponents, and the Covenanters, who had already enforced the signature of the Covenant in Scotland, entered into the English Civil War, in 1643–4, as allies of the Parliament, on the basis of a Solemn League and Covenant to establish uniformity in Church government, doctrine, and ritual throughout the Three Kingdoms. The object of the Scots was the establishment of Presbytery as the exclusive form of Church government in England as well as in Scotland. A Scottish army, under Alexander Leslie, Earl of Leven, had an important share in the great victory of Marston Moor (1644), but the English Parliament, even with Scottish help, failed to beat the Royalists, and the assistance given by the Scots was reduced by the recall of troops to meet a Royalist rising at home, under the Marquess of Montrose, who had originally been a Covenanter, but had espoused the cause of the king. Montrose, with an army composed of Highlanders, and of Episcopalians from the north-eastern counties, won in 1644–5 a series of victories at Tippermuir, Inverlochy, Auldearn, and Kilsyth, but was completely defeated by David Leslie (Leven's nephew) at Philiphaugh (Sept., 1645). Meanwhile, in England, a new organization, the New Model Army, won the decisive battle of Naseby (June, 1645), and the power soon passed from the Parliament to the real victors, Cromwell and his soldiers, who, as Independents in religion, detested the Solemn League and Covenant. Charles I surrendered to the Scottish army in England (1646), but, as he refused to take the Solemn League and Covenant, he was handed over to the English Parliament, and his person was ultimately seized by the leaders of the New Model Army. The Parliament was not in a position to carry out its agreement with Scotland, and, irritated by the English failure to establish Presbytery in England, a section of the Scots entered into an 'Engagement' with Charles I, who undertook to establish Presbytery in England for three years. The Engagers, under the Duke of Hamilton, were defeated by Cromwell at Preston (Aug., 1648), but the execution of the king in Jan., 1649, brought about a Royalist reaction in Scotland. Charles II took the Covenant and came in person to Scotland, but Scottish armies were defeated by Cromwell at Dunbar (1650) and at Worcester (1651), and until 1660 Scotland was under English government and became part of the Commonwealth of England, Scotland, and Ireland. The visit of Charles II had divided the Covenanters into two bitterly opposed sections, and these divisions remained after the Restoration.



The reigns of Charles II (1660–85) and James VII (1685–8) form the most miserable period of Scottish history. The Church was made episcopal in government, though no effort was made to secure uniformity in ritual with the Church of England. The Parliament, entirely under royal control, passed Acts enforcing religious conformity, and Presbyterians who met for worship outside the parish churches were subjected to a rigorous persecution which, in spite of occasional attempts at conciliation, became more and more fierce. Two rebellions, in which were fought the battles of Rullion Green (1666), and Drumclog and Bothwell Bridge (1679), led to cruel reprisals, and death became the penalty for attendance at a conventicle or unlicensed meeting for religious worship. The last years of the period (1680–7) became known as the 'Killing Time'. The civil government was incompetent and corrupt, and trade and commerce decreased. The English Revolution in the end of 1688 was welcomed in Scotland, though there was a strong party for King James, consisting of Episcopalians and Roman Catholics.

(6) *The Union of the Kingdoms*.—The recognition of William and Mary by a Convention Parliament in 1689 was followed by the disestablishment of the Episcopal Church, and by the restoration of Presbytery (1690). The Revolution also marks a new era in Scottish constitutional history, for the Parliament, freed from royal control, enjoyed powers similar to those which had been secured by the English Parliament. The Union of the Crowns thus became an inadequate constitutional arrangement. It had worked well enough under an absolute monarchy, but the position of a constitutional sovereign, guided by two separate Parliaments, might easily become impossible, and it was evident that a more complete union was necessary. William (1689–1702)—he was William II in Scotland—became so unpopular that the movement towards union was checked. The Jacobite party had melted away after the death of its leader, Viscount Dundee (Graham of Claverhouse), at Killiecrankie (1689), but some years elapsed before all its members took the oaths to the new Government, and an incident in this process, the Massacre of Glencoe (q.v.) brought much obloquy upon William. He also incurred much odium by his conduct in connection with the Darien Scheme (q.v.), and the result of that unfortunate attempt to found a Scottish colony was the creation of a bitter hostility between Scotland and England. At the accession of Queen Anne (1702–14) the situation was such that the two nations had to choose between war and union. Wise counsels prevailed, and a union of the Kingdoms and Parliaments was accomplished in 1707.

(7) *Scotland since the Union*.—The Union of the Kingdoms brought at first little but disappointment, for, in the years immediately following it, Scottish commerce was rather checked than increased by the economic changes produced by free trade with England, and the Patronage Act, passed by the British Parliament in 1712, produced a division in the Church (which ultimately culminated in the Disruption of 1843). Scottish discontent led, on the accession of George I, to the Jacobite Rising of 1715–6, which, if it had not been mismanaged, might have seriously menaced the security of the House of Hanover; but the Earl of Mar was an incompetent leader, the help which had been promised by France was not forthcoming, and the attempt of the Jacobites, who had assembled in Mar's country, to reach Edinburgh was frustrated by the battle of Sheriffmuir (Nov., 1715). The long period of peace under Walpole, and the rapid growth of trade and commerce (best illustrated by the development of Glasgow), reconciled the Lowlands to the Union and the Hanoverian House; the Rising of 1745–6 had little popular support outside the Highlands, and its importance was due to the leadership of Prince Charles Edward, and to the circumstance that a French war had denuded the country of Government troops. Prince Charles seized Edinburgh, won the battle of Prestonpans (Sept., 1745), made an unsuccessful march to Derby, and on his return defeated General Hawley at Falkirk (in January), but his invasion, though it had the glamour, never possessed the potency of success. After his defeat at Culloden (April, 1746) new legislation abolished the administrative authority of the Highland chiefs and other landlords, and a new era began in agriculture and commerce. From the accession of George III, Scotsmen began to take part in the political affairs of the United Kingdom, and the end of the eighteenth century was the greatest period of Scottish intellectual development. The pre-Union parliamentary franchise was maintained until 1832; and the Scottish people had nothing like adequate representation until the first Reform Act. Up to that date the Scottish members of the House of Commons had generally been at the disposal of the Government, but from 1832 the electorate, widened by successive Franchise Acts, has taken its full share of political responsibility. Since then Scotland has developed in accordance with the rest of the United Kingdom, and the most important individual episode was the Disruption. —BIBLIOGRAPHY: A. Lang, *History of Scotland*; Hume Brown, *History of Scotland*; P. Hill Burton, *History of Scotland*; R. S. Rait, *Scotland* (in The Making of the Nations and in the Home University Library); G. Eyre-Todd, *The Story of Glasgow*.

The Church of Scotland.—The National Church of Scotland by law established. It is Protestant in faith, Calvinistic in doctrine, and Presbyterian in government. It includes within its pale roughly half of the population. According to the latest returns it has 1456 Parish Churches, 248 Mission Churches, and a Communion Roll of 728,239. Its chief endowment consists of Teinds, or tenths of the produce of the soil, now valued at one-fifth of the rental. In addition it has large voluntary endowments.

History.—For the early history section (5) above, *The Religious Struggles.* From 1592 onwards for a century there was an involved struggle between Episcopacy and Presbytery, ending in 1690 with the triumph of the latter. In that year the Scottish Parliament passed an 'Act for securing the Protestant Religion and Presbyterian Church Government in Scotland'. This Act was afterwards admitted by the English Parliament to be 'in all times coming an essential and fundamental part of the Union'. The most important event in the history of the Church of Scotland since 1690 is the 'Disruption' of 1843 (see *Free Church of Scotland*). In 1875 the system of popular election of ministers was introduced, the right of presentation being taken from patrons and vested in communicants and adherents, male and female. *System of Government.*—The Constitution of the Church consists in four courts. The lowest of these, the Kirk Session, composed of the minister and two or more (without limit of number) lay elders, takes charge of the moral and spiritual interests of the parish. The Presbytery, the next in order, consists of the minister and one representative elder from each of the parishes within its bounds. It exercises episcopal functions over all its members and churches, ordains and inducts ministers to vacant parishes, and licenses students to preach. At present (within Scotland) there are eighty-four Presbyteries, in which the Parishes are geographically grouped. The next in order is the Provincial Synod (there are twelve Synods in Scotland) which consists of all the ministers and elders who are members of the various Presbyteries within its bounds. This court deals with cases brought before it by appeal from the Presbyteries.

The highest court of the Church is the General Assembly, consisting of ministers and elders commissioned by the Presbyteries, Universities, Royal Boroughs, and the Church of Scotland in India. It meets annually in May at Edinburgh, presided over by a moderator, a minister appointed by the Court at its first meeting, and now usually nominated previously by what has come to be known as the College of Moderators (ministers who have previously held this office). The Assembly is opened by the Lord High Commissioner, a representative of the ruling sovereign, appointed for the occasion. The business of the Assembly is to consider weighty matters of the Church, to hear petitions, appeals, complaints, &c., sent up from the lower courts, to hear the reports of the various committees of the Assembly and to decree action accordingly. From its decision there is no appeal. Within its own sphere it is entirely independent of the Civil Courts. It deals with all questions of public interest—especially social questions that may arise

Ethnology.—The earliest contemporary source for Scottish ethnography is to be found in the pages of Tacitus, who describes the inhabitants of Britain as they were in the latter part of the first century. He attributes to the Caledonians of North Britain, where they were apparently the dominant tribe, certain physical characteristics which suggested to him a Germanic origin. By later Roman writers these Caledonians were included in the general body of the people whom they named Picts, and who are identifiable with the 'various inhabitants' of Caledonia mentioned by Tacitus. The name 'Picts' is of doubtful significance. It is usually associated with the supposed prevalence among the Caledonian tribes of painting their bodies, but it may be a Roman adaptation of a Celtic word denoting physical smallness; and it is a fact that all over Scotland the traditions of the peasantry make the Picts a small and uncanny people. The word *picht*, still alive in Scots dialect, implies smallness. It seems likely that the name may have been originally applied to the relatively small predecessors of the historical Picts (who are believed to have been a big people physically), and, subsequently, to themselves. There are well-known historical analogies for conquerors adopting the national name of the conquered. (See *Picts.*)

Even if the palæolithic peoples are left entirely out of consideration, there must have been, at the commencement of the Christian era, important elements in the population, consisting of the descendants of the Neolithic folk of the chambered cairns, and the Bronze Age people of the stone circles. Traits of the dark, long-headed, and rather short Iberian (or Mediterranean) people of the New Stone Age, and their taller, fairer, and rounder-headed successors, are discoverable in Scotland at the present day. The Iberian tribes were doubtless enslaved by their physically superior, but mentally less alert, conquerors, and the latter appear to have been the ruling caste, the historical Picts. Whether Celts or Teutons, or both, their physical traits were doubtless Nordic, for the Celts described by Cæsar were physically similar to the Germans. Some anthropologists have used the word

'Celtic' to define the short, dark, broad-headed type, sometimes labelled 'Alpine', but the Celts of Roman history were undoubtedly big, fair men. Whether the historical Picts were Iberians, or Cymric Celts, or Gaelic Celts, or Teutons, as rival schools of theorists have respectively claimed, or a congeries of races embracing all these, as seems to be the most plausible conclusion, it is at least certain that the earliest existing place-names of Scotland, some dating as far back as the first and the second centuries, betray unmistakably Celtic roots with, more doubtfully, some Old Icelandic (Old Norse) characteristics. And it is also certain that these Celtic names are closer relatives of the Cymric than the Gaelic branch of the Celtic language.

There is evidence that Celts of the Cymric branch dominated the whole of Britain prior to the arrival of the waves of immigration from Northern Europe which beat against the shores of the island in successive centuries. The historical Picts, mainly Cymric, had almost certainly important Scandinavian, and possibly some non-Aryan, elements—a supposition that is strengthened by an analysis of the few Pictish words that are known. We have the contemporary statement of a completely trustworthy authority that their language was different from Anglo-Saxon, British (Cymric), and Scottish (Gaelic). It seems to have been a mixed language, and when it is considered that it was spoken by a mixed people, it could scarcely have been otherwise. Its development, in all probability, took a line corresponding with the volume of immigration across the North Sea and the gradual displacement of the Celtic element in the population (more particularly) of North-East Scotland. The Scottish dialect in the south-east of Scotland is derived mainly from the Angles of Northumbria; but there is evidence for the assumption that the dialect of the north-east is not of Northumbrian origin, but had an independent development. It contains words that are practically identical with Old Frisian, while others are clearly of Celtic origin. Conceivably, when in the ninth century the Picts and the Scots became one nation, the Pictish vernacular may not have differed essentially from the earliest forms of what is now known as *broad Scots*. This was not the original language of the Scots, but being in a numerical minority, though constituting the ruling caste, they appear to have gradually adopted the speech of the majority, their own language, very slowly, but very surely, finding a more permanent home in the less mixed, because more isolated, populations of the Highlands and Isles. Thus, in time, the Scots spoke a tongue which received the name of *Scottish*, because spoken by the Scots, while their original language became known as 'Irish', to denote its country of origin: for the Scots came from Ireland, where they were the ruling caste, the mass of the population being called Hibernians (Iberians). Their own name for themselves was *Gœdel* (pronounced *Gäel*), a word that seems to mean co-sharer. They spoke the language of the *Gael*, that is, Gaelic, the branch of Celtic that is still spoken in Ireland, the Highlands of Scotland, and the Isle of Man. The first settlement of Scots in that part of Britain afterwards named successively Alban and Scotland is traditionally ascribed to the third century of our era, and in the following century they figure in Roman accounts as marauders, preying, in association with the Picts, on the Romanized and enervated Britons. There are sound historical grounds for the ascription to the fifth (late) or sixth (early) century of the foundation of the Scottish Kingdom of Dalriada (Argyll), and there is reason to believe that a nucleus of Scottish influence was also formed in Fife. The Scots in the west were divided from the Picts in the east by the watershed (anciently called Drumalban) between Argyllshire and Perthshire.

Similarly, south of the Firths of Clyde and Forth there were two nations: the Britons, who spoke a Cymric tongue, in the west, and the Anglians, who spoke the Northumbrian dialect of Anglo-Saxon, in the east. The Britons and the Picts lost Lothian to the Angles of Northumbria, whose sway over North Bernicia extended to the Firth of Forth. But the Britons retained their hold over Strathclyde, where their great fortress of Alcluyd (Dumbarton) was an impregnable base. Galloway was in the hands of a colony of Picts who, there is evidence to show, were Odin-worshippers in the sixth century. The Galwegians retained special privileges long after the consolidation of the Scottish monarchy.

These four nations were in a state of constant warfare until the ninth century. Finally, the forced union of the Picts and Scots (844), under the rule of Kenneth macAlpin, who had affinities with both races, was the first step in the consolidation of the peoples who afterwards became the Scottish nation. The last shred of Anglian control over any portion of what is now Scotland was destroyed by the Scottish victory at Carham in 1018; but Anglian blood and the Anglian tongue persist in Lothian to this day.—BIBLIOGRAPHY: W. C. Mackenzie, *Races of Scotland and Ireland*; W. F. Skene, *Celtic Scotland.* See *Gaelic.*

Mythology.—The folk-lore of the Highlands and Lowlands bears evidence of archaic survivals of special interest. A remedy for children *in extremis* in the north Highlands until recently was the liver of a mouse. Roasted mouse was a cure for whooping-cough and smallpox, as in various parts of England. An Irish manuscript story refers to a ceremonial mouse feast in Scotland (*Revue Celtique*, xiii). The mouse-Apollo cult may have reached Scotland. A Perthshire standing stone is called in Gaelic 'Stone of my little mouse'—'little' signifying 'dear' or 'sacred'. Mice were supposed to paralyse the limbs of human beings or animals by running over them by night. Another interesting survival is the Highland prejudice against pork. The black pig is connected with the devil. In Gaelic the story of Osiris has been attached to the memory of Thomas the Rhymer. Lowland and Highland stories refer to an Underworld in which the dead are seen cutting corn and plucking fruit, as in the Osirian Paradise. It has been suggested that these myths survive from the time when the agricultural mode of life was first introduced. Charms for curing diseases are common, and hereditary 'curers' are still known. Medicinal plants like the mugwort have been connected with early Christian saints. The hazel is referred to as 'a god'. Hazel-nuts and apples are fruits of immortality in the Gaelic Paradise. The 'milk' of the unripe hazel-nut was given to Highland children, as was 'fig milk' to Greek children. Hazel fire-sticks were used to kindle 'new fire', and in the *Life of St. Kentigern*[1] the saint makes fire from a hazel branch. The rowan is another sacred tree; its berries are the food of supernatural beings. The bee is a soul form, and honey and hazel-nut milk constituted an elixir still remembered as a cure in the Highlands. A Hebridean deity dwells in a tree on a mound, and provides in a sea-shell, called 'cup of Mary', the 'milk of knowledge' for women. Bride (the goddess Bridget) is supposed to come from the Other-world on 1st Feb. (old style), which is in Gaelic *Feill Bride*. Her serpent wakes from its winter sleep on the same day. The *nathair challtuinn* ('snake of the hazel-grove') may be the same as Bride's. There are two suns in Gaelic—the 'big sun' of summer and the 'little sun' of winter. Bride rules during the 'big sun' period. The 'little sun' period is controlled by a fierce 'Old Wife' who has one eye on her forehead. Her chief seat is Ben Nevis. She wanders among the mountains followed by herds of wild animals, including deer, goats, and swine. Various storms are raised by her, and named in connection with her in the Gaelic Calendar. Fires were lit at Beltain ('white fire'), at Hallowe'en (in Gael. *Samhain* = 'summer end'), and at midsummer. Other 'need-fires' (in Gael. 'friction fires') were lit to charm cattle from disease as occasion arose. In Gaelic the cardinal points are coloured, the north being black, the south white, the east purple, and the west dun. A number of Gaelic words of good omen are based on the name for the south, which is on the right, and a number of words of bad omen on the name for the north, which is on the left. The east is 'before' (in front) and the west 'behind'. A Gaelic saying is that 'evil never came from the east'. In folk-stories demons and giants come from the north; the wind-hag of spring comes from the south-west; the fairies always come from the west on eddies of wind like the Greek nereids. The fairy is in Scottish Gaelic *sith* (pronounced *shee*), a word which refers to anything unearthly or supernatural, and to the silence of supernatural beings whose footsteps are never heard. Skin rashes that appear in certain diseases are called *breac shith* ('supernatural specks'); the cuckoo, which is supposed to dwell in the Underworld all winter, is an *eun sith* ('supernatural bird'). Other supernatural animals are *cro sith* ('supernatural cows') and *cait sith* ('supernatural cats'). The water-horse (kelpie), the urisk (satyr), the mermaid, brownie, blue men (sea-gods), &c., are also known.

Literature.—During the *early* period, extending to near the end of the fifteenth century, there was little difference between the language of Scotland and that of England north of the Humber. In the *middle* period, which extended to the Union, it was influenced in a slight degree by the Gaelic, and in a more pronounced manner by French and Latin, consequent on the French alliance and the revival of learning. During the *modern* period the language, as used in popular poetry, &c., has been to a considerable extent affected by modern literary English, though the genuine vernacular may still be heard in many districts with dialectic peculiarities according to locality.

The *Sir Tristrem*, a metrical romance, doubtfully attributed to Thomas the Rhymer, is by some regarded as the earliest piece of Scottish literature, and is generally accounted the earliest specimen of romance poetry in Britain (end of the thirteenth century). But the first undoubted specimen of Scottish literature is the *Bruce* of Barbour (about 1375; see *Barbour*). Between 1420 and 1424 was written Wyntoun's *Oryginale Cronykil of Scotland*, and about 1460 Henry the Minstrel, commonly called Blind Harry, did for Wallace what Barbour had done for Bruce. Another of the poets of this early period is no less a personage than James I (1394–1437), author of the *King's Quhair*. *Christis Kirk of the Grene* and *Peblis to the Play*, long believed to have been productions of James, have to be attributed to some other early poet. Down to the middle of the sixteenth century four names stand out prominently, viz. Henryson, Dunbar, Gavin Douglas, and Sir David Lindsay. Minor poets of this period were Walter Kennedy, Sir John

---

[1] There are two *Lives*, one by Joscelinus, a monk of Furness, and the other by an unknown hand. The former is meant here.

Rowll, Quintin Shaw, and Patrick Johnstone. In 1536 John Bellenden, Archdeacon of Moray, published the *Hystory and Croniklis of Scotland*, a translation of Boece's *Historia gentis Scotorum*, which was also versified by William Stewart, a descendant of the first Earl of Buchan. The anonymous *Complaynt of Scotland* (1548) is of value as preserving the titles of several popular pieces of contemporary literature now lost, and as a piece of early prose. The poems of Sir Richard Maitland (1560) are curious, but his title to remembrance as well as that of George Bannatyne (1568) rests on their extensive MS. collections of Scottish poetry, the one preserved in the Pepysian Library at Cambridge, the other in the Advocates' Library, Edinburgh. With the exceptions of Alexander Scott, Arbuthnot, Rolland of Dalkeith, Alex. Montgomery, Sir William Alexander, and Drummond of Hawthornden, about a century and a half now elapses before we come upon the name of any eminent Scottish poet; most of the scholars of that period, such as Major and Buchanan, addressed themselves to the world at large and wrote in Latin. We have, however, vernacular prose works of merit in Lyndsay of Pitscottie's *Chronicle*, and Knox's *History of the Reformation*. In the third period of the language, when it had become a provincial patois, the first notable name is that of Allan Ramsay (1686–1758), author of *The Gentle Shepherd*, and of numerous shorter pieces and songs. To this same age belongs also nearly the whole of that remarkable body of song known as the Jacobite minstrelsy. The Scottish ballads, ever since the publication of Percy's *Reliques*, have engaged much attention, and have been carefully collected and illustrated by Sir Walter Scott and other editors. The list of the more prominent successors of Ramsay is closed by the names of Fergusson, Burns, Hector Macneil, Scott, James Hogg, and Tannahill; while the vernacular prose writers may be said to be represented by John Galt, Hogg, Sir Walter Scott, George MacDonald, and others.—BIBLIOGRAPHY: J. H. Millar, *A Literary History of Scotland*; T. F. Henderson, *Scottish Vernacular Literature*; G. Eyre-Todd, *Scottish Poetry*; H. Walker, *Three Centuries of Scottish Literature.*

Scots Greys, Royal (now the **2nd Dragoons**), a celebrated British regiment first raised in Scotland for the service of Charles II, 15th Nov., 1681. It was the first regiment of British dragoons, and was originally called the Royal Regiment of Dragoons of Great Britain. They derive the name of Scots Greys from the grey chargers on which they used to be mounted. The Scots Greys bear on their colours the thistle within the circle and motto of St. Andrew, an eagle, the motto 'Second to None', and the names of Blenheim, Ramillies, Oudenarde, Malplaquet, Dettingen, Waterloo, Balaklava, Sebastopol, South Africa, &c. Uniform scarlet, blue facings, white plume. They took part, as dismounted troops, in the battles of Ypres (1914 and 1915).

Scott, David, Scottish historical painter, born 1806, died 1849. In 1828 he exhibited his first picture, *The Hopes of Early Genius dispelled by Death*. In 1832 he visited Paris and Italy, and on his return to Edinburgh was elected a member of the Scottish Academy (1835). Among his chief pictures are: *Vasco de Gama encountering the Spirit of the Storm at the Cape*, *Queen Elizabeth at the Globe Theatre viewing the performance of the Merry Wives*, *The Duke of Gloucester carried to Prison* (Scott's finest work), and *Ariel and Caliban*.

Scott, Sir George Gilbert, British architect, born 1811, died 1878. He had a great share in the revival of Gothic architecture in Britain. Many churches, colleges, and other public buildings were built from his designs, among them the church of St. Nicholas at Hamburg, the spire of which is 478 feet high; the Foreign Office, the India Office, and the Home and Colonial Offices, London; Glasgow University, the Memorial to the Prince Consort, London; and St. Mary's Cathedral, Edinburgh. He also restored many important minsters and churches such as the cathedrals of Ely, Lichfield, Hereford, Ripon, Gloucester, Chester, St. David's, St. Asaph, Bangor, Salisbury, and St. Albans.

Scott, or Scot, Michael, Scottish mathematician and astrologer, was born about 1175, and died about 1232. He was educated at Oxford, Paris, and Bologna, learned Arabic in Toledo, and became astrologer to Frederick II in Sicily. He was appointed by the Pope Archbishop of Cashel, but declined the post. Legend has transformed him into a magician, and he is mentioned as such by Dante and Boccaccio. He plays a prominent part in the superstitions of the Scottish borders.—Cf. J. Wood Brown, *Life and Legend of Michael Scot.*

Scott, Michael, Scottish novelist, born at Glasgow in 1789, died in 1835. Scott's fame rests on his two novels *Tom Cringle's Log* and *The Cruise of the Midge*. These two brilliant sea-novels appeared anonymously in *Blackwood's Magazine.*

Scott, Robert Falcon, British explorer, born 1868, died 1912. He entered the Royal Navy in 1882, and became captain and C.V.O. in 1904 on the return of the *Discovery* (National Antarctic Expedition, 1901–4), which he commanded. In 1910 he sailed again for the Antarctic aboard the *Terra Nova*, a whaler, and succeeded in making a brilliant dash to the South Pole, only to find that he had been forestalled by the Norwegian explorer Amundsen. On the return journey he and his companions, Oates, Bowers, Wilson, and petty officer Evans, perished in a blizzard.—Bibliography: R. F. Scott, *Voyage of the Discovery*; *Scott's Last Expedition* (arranged by L. Huxley); H. G. Ponting, *The Great White South*; E. R. Evans (Captain), *South with Scott.*

Scott, Sir Walter (1771–1832) was born on the 15th of Aug., 1771, in College Wynd, Edinburgh. His father, Walter Scott, a successful Edinburgh lawyer, had married Anne Rutherford, the eldest daughter of a well-known physician, Professor John Rutherford. Scott was the ninth child of the family, of which the first six died in infancy.

He was, as he tells us in his autobiography, a particularly healthy child till he was eighteen months old; when teething troubles brought on a form of infantile paralysis; and he lost the power of his right leg. Everything that the medical knowledge of the time could suggest, was tried; and at last it was decided to try country air; so he was sent to his grandfather at Sandy Knowe. Here it was that Scott, as he tells us, first became conscious of his own existence, and realized that his situation and appearance were somewhat whimsical. At Sandy Knowe his Aunt Janet read to him such books as she thought would interest him, and his grandmother told him endless stories of old border raids.

At about the age of four he was sent under the care of his aunt to try the waters of Bath, then the most fashionable watering-place in Britain. The child and his aunt travelled to London by sea; and, after a few days in London, crossed to Bath where they stayed for a year, and where Scott attended a dame's school and learned to read. He was taken by his uncle, Captain Robert Scott, to the theatre, and saw *As You Like It*, which made a very deep impression on him. A year later Scott was brought back to his father's house in George's Square, Edinburgh, where he remained only for a short time. He was sent again to Sandy Knowe, and there, with the exception of a short period spent at Prestonpans for sea-bathing, he remained till his eighth year.

Returning to Edinburgh, he was sent, after a short time, to the High School, where, as he tells us, he made a brighter figure in the 'yards (or playground) than in the class'. His popularity at school was due not merely to his kindliness and good nature, but to the wonderful tales with which he was able, even then, to enthral his youthful hearers.

Encouraged by his mother he read Shakespeare, and guided by the blind poet, Dr. Blacklock, he extended widely his acquaintance with English literature. He read Spenser's *Faerie Queene*, and was delighted with it; Hoole's translation of Tasso's *Jerusalem Delivered*, and Bishop Percy's *Reliques*; and he made acquaintance with the works of Richardson, Fielding, and Smollett. Yet his school work was so unsatisfactory that his father considered him 'incorrigibly idle'; and, as his health was affected by his rapid growth, sent him to Kelso, to be cared for by his aunt. At Kelso he attended the Grammar School four hours daily, and seems both to have profited from the instruction received and from the beauty of his surroundings.

Recalled to Edinburgh, he began his classes at the college; but after a time fell ill and was again sent to Kelso to his aunt.

In 1786 he was apprenticed to his father, and began to acquire regular business habits, and to show that persevering industry for which the whole of his later life is so remarkable. With his most intimate friend for the time being, John Irving, he used to wander over Arthur's Seat, each by agreement recounting some romance he had composed for the other's amusement. A severe illness, caused by the bursting of a blood vessel, interrupted his studies for a time; but Scott completely recovered from it, and grew tall and strong, taking a special delight in long rides, and, in spite of lameness, long walks. Two years after he began his apprenticeship Scott took the civil law classes at the College, and with the approval of his father decided to become an advocate. When not wandering over the country in search of natural beauties, places of historic interest, and local legends, Scott and his friend, William Clerk, set themselves with steady industry to prepare for the necessary advocates' examination, each acting as coach for the other. In the course of his duties as his father's apprentice, he visited, among other parts of the Highlands, Loch Katrine, and made the acquaintance of Alexander Stewart of Invernahyle, a gentleman who had 'been out' in 'the fifteen' and in 'the forty-five', and who had met Rob Roy in a duel. He became a member of several Edinburgh clubs, and began to be noted as a young man whose antiquarian knowledge was surprising. He seems, in fact, to have filled up every moment of his time to his physical as well as mental profit.

In 1792 he was called to the Bar, and towards the end of the year he made his first raid on Liddesdale in the company of Robert Shortreed, the Sheriff-Substitute of Roxburgh. For seven years in succession he explored every corner of the south-west of Scotland, collecting ballads, and enjoying the kindly, if homely, hospitality of the country people. Everywhere he was welcomed with pleasure; for, though bubbling over with fun, he was always a sympathetic and courteous gentleman. During these years also he wandered widely in Lanarkshire, Perthshire, Stirlingshire, and Forfarshire, acquiring that knowledge of Scottish peasant life and character with which he was afterwards to charm his readers. Intensely patriotic, the progress of events after the French Revolution led him to join in 1797, as quartermaster, a volunteer regiment of horse. In the same year he married Charlotte Mary Carpenter, the daughter of a well-to-do French Royalist, Jean Charpentier, who died early in the Revolution, and whose wife and family had come to England for safety.

The young couple settled in lodgings in George Street, and from there moved to Castle Street. For their summers they had taken a cottage at Lasswade. Several tentative efforts including a version of Burger's *Lenore*, the *Wild Huntsman*, a translation of Goethe's play *Goetz von Berlichingen* and some ballads had been published by Scott, and had met with only moderate success; then there appeared in 1802 the *Border Minstrelsy*, the result of Scott's years of ballad collecting; and it was received with delight by the reading public. In 1799 Scott had been appointed Sheriff-depute of Selkirkshire; and he was forced by his duties to give up the cottage at Lasswade and to lease Ashestiel, a house belonging to his cousin, General Russell. Meantime, besides his duties as Sheriff-depute, Scott had taken over from George Home the duties of principal clerk of the Court of Session, and performed them for years before he got any remuneration. In the *Minstrelsy* there had been poems by Scott himself, in imitation of older ballads, that raised great expectations with regard to original work by him; and these expectations were fully realized when *The Lay of the Last Minstrel* appeared in 1805. Scott meantime was writing the life and editing the works of Dryden, of whom he was always a great admirer. In addition to editing Dryden's works, and performing the duties of Secretary to the parliamentary commission on Scots law, Scott, during the following three years, wrote *Marmion*, which is thought by many the finest of his poems. In 1809 he visited London and there made the acquaintance of Mr. J. B. Sawtry Morritt, at whose place, Rokeby, he rested on his return journey.

In 1810 Scott's third romance in verse, *The Lady of the Lake*, was published, and was at least as great a success as the two previous poems. Over 20,000 copies were sold in the year, and so interested were the public in the scenery described that there was a great rush of visitors to Loch Katrine. The *Vision of Don Roderick*, published for the benefit of the distressed Portuguese and written in the Spenserian stanza, appeared in 1811. *Rokeby* was published in 1812, and *The Bridal of Triermain* early in 1813. In Oct., 1816, Scott published for the benefit of soldiers' widows a poem on the *Field of Waterloo*, and in Jan., 1817, the last of his longer poems, *Harold the Dauntless*.

Scott's poems had been read by the public with enthusiasm. In them he had shown himself a true 'seer'. It was impossible to read them and not to realize vividly the scenes described; impossible reading his descriptions of battles not to feel the pulse quicken and the heart thrill; but there was an even finer element in these romance poems—each breathed a spirit of love of right; of love of country; of faith in goodness; of sympathy with suffering; of fairness to foes, that could not fail to make the readers better men and women.

Scattered through the poems are many fine songs, but none more exquisite than Madge Wildfire's song in the *Heart of Midlothian*, "Proud Maisie is in the wood, walking so early"; unless, perhaps, the song in *Rokeby*, "A weary lot is thine, fair maid". But it is almost impossible to exaggerate the charm of Scott's lyrics.

In 1814 Scott published a *Life of Swift* and an edition of his works in 19 volumes. Two years before, he and his family had left Ashestiel where he had lived for some seven or eight years, endearing himself to all classes of the people of the neighbourhood, and had taken up his abode at Abbotsford. Here, while looking for some fishing tackle, he came across the first part of *Waverley*, which in deference to the criticism of his friends, Erskine and Ballantyne, he had laid aside some ten years before. Scott read the portion previously written; thought his critics mistaken; wrote the two volumes which were needed to complete the novel; and published it anonymously. The public eagerly welcomed the work of the unknown author. It was published in July, and the sixth edition appeared before the end of the year. What was more astonishing, it was followed in 1815 by *Guy Mannering* and *The Antiquary* by the same anonymous author. From his boyhood Scott had lived in an atmosphere of story and legend, to which these novels gave new form and substance. Between 1813 and 1819 no fewer than nine of these exquisite studies of Scottish life and character appeared. *The Black Dwarf* and *Old Mortality* were published in 1816; *Rob Roy* in 1817; *The Heart of Midlothian* in 1818; and *The Bride of Lammermoor* and *The Legend of Montrose* in 1819.

Scott's health at this time was far from good. In April, 1819, we are told that in expectation of immediate death he took leave of his children. He was greatly worried too with money troubles, caused by the difficulties of the business firm of Ballantyne and Company, to which he belonged, and by the debts contracted in the extension of the Abbotsford estate, and the erection of the mansion house; yet in this year of trouble in addition to the two novels already named, he struck out to the joy of the reading public a new line in *Ivanhoe*. *The Monastery* and *The Abbot* appeared in 1820, the year in which the author accepted his baronetcy from George IV; but were not so popular as the previous novels had been. Undeterred by the check, Scott, who had begun his *Life of Napoleon*, gave the world *Kenilworth*, one of his greatest novels, in Jan., 1821, and *The Pirate* in December of the same year. In the following year he published *The Fortunes of Nigel*, a study of the times of James I and VI; and next year *Peveril of the Peak*, *Quentin Durward*, and *St. Ronan's Well.* Though *Quentin Durward* received rather a cold reception in Britain, it was hailed with delight in France and on the Continent generally, where Scott's works had led to that ' romantic revival ', which was so marked a literary feature of the first half of the nineteenth century.

The failure of Scott's publishers, Constable and Cadell, and of the firm of Ballantyne and Company, of which he was the head, brought him to the verge of ruin. Never was there a harder test of the worth of a man than that Scott had now to meet, and never was test more triumphantly passed. He refused to become bankrupt and determined to carry on the business for the benefit of his creditors. He laboured ceaselessly with this end in view. Household and general expenses were reduced as low as possible. Sometimes twelve to fourteen hours a day were devoted to writing. *The Betrothed* and *The Talisman* appeared in 1825, and *Woodstock* in 1826. In 1827 his *Life of Napoleon* in 9 volumes was published, and the copyright sold for £18,000. The same year saw the publication of the *Chronicles of the Canongate*, *The Two Drovers*, *The Highland Widow*, and *The Surgeon's Daughter*, and a sum of no less than £40,000 was paid to his creditors.

As soon as *Napoleon* was finished he began his wonderful *Tales of a Grandfather*, a child's History of Scotland, which was received by the reading public with as great enthusiasm as any of his novels had been. His wife, Lady Scott, had died in 1826, and the same year saw the famous letters of Malachi Malagrowther against the proposed changes in the currency law appear in the Edinburgh *Evening Journal.* The year 1828, which saw the appearance of the First Series of the *Tales of a Grandfather*, saw published also *The Fair Maid of Perth*; and the Second Series, published in 1829, was followed by *Anne of Geierstein.* The Third and Fourth, the concluding series of the tales, appeared in 1830, and the same year Scott had a paralytic or apoplectic attack from which he never quite recovered. *Count Robert of Paris* was written after this attack, as were his *Letters on Demonology and Witchcraft*, and the last of his novels, *Castle Dangerous.* Another severe attack in 1831 led Scott, urged by his friends, to go on a tour in Southern Europe. He returned home by way of the Tyrol. At Nimeguen he had another attack of paralysis in June, 1832. He was brought home and died at Abbotsford on the 21st Sept., 1832, surrounded by his children and by his faithful and loving friends and dependents.

Some idea will be gathered from the account given of what Scott did for his country and for the world. Millions in Britain and millions abroad have read and enjoyed those wonderful stories known as the *Waverley Novels.* Many have read them again and again, and there have been not a few who have taken such pleasure in them that they have read them once every year of their life after making their first acquaintance with them. Nor is it at all surprising that such is the case. Unlike Dickens and Thackeray, the greatest of his successors, Scott never preaches. He tells his story as we imagine it actually took place, and leaves the reader to draw his own lessons and his own conclusions; but no one can read one of his stories without being the better for having done so. The greatness and the wonder of Scott were fully recognized in his own time. His characters are so real, that having made their acquaintance, we never think of them as characters in a book, but as amusing or interesting people we have met. In this respect he is like Shakespeare; and, whether he is dealing with historical characters like Richard I or Louis XI, or Queen Elizabeth or the unfortunate Margaret of Anjou, or with purely fanciful characters like Jeanie Deans or Madge Wildfire, or Mause Headrigg or Jenny Rintherout, they assume a form and substance which distinguishes them from the creations of other writers. The names of other novelists are specially associated with some one story, as Fielding's name is with *Tom Jones*, Smollett's with *Roderick Random*, and Dickens's with *David Copperfield* or the *Pickwick Papers*; but it is not so with Scott. Critics are not agreed as to which is the greatest of his novels. *The Heart of Midlothian* say some, *Guy Mannering* say others, while many give their voices for *The Antiquary, Old Mortality, Rob Roy, Kenilworth*, or *The Fortunes of Nigel.* Surely there could be no stronger proof of the adequacy of the several presentations. In Britain there are two literary shrines to which grateful readers from all parts of the world come to do reverence; the one is at Stratford-on-Avon, the other Abbotsford. Sir Walter is certainly Scotland's greatest writer, and one of the world's best and greatest men.

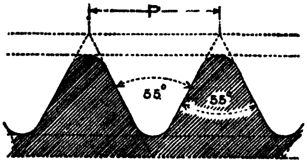
BIBLIOGRAPHY: For information about Scott, besides Lockhart's *Memoirs of the Life of Sir Walter Scott*, the following may be consulted: *Domestic Life and Manners of Sir Walter Scott*, by James Hogg (1834); *Scott's Last Journals* (1890);

and *Scott's Familiar Letters* (1894); *Recollections of Sir Walter Scott*, by R. P. Gillies (1837); *Reminiscences of Scott*, by John Gibson (1871).

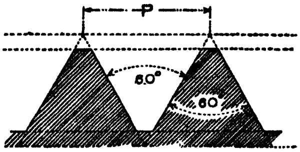
Scranton, a city of Pennsylvania, United States, the county seat of Lackawanna county, on the Lackawanna River. There are large rolling-mills and steelworks, and extensive manufactures of railway rolling-stock, machinery, edge-tools, nuts and bolts, leather, window sashes and blinds, silk fabrics, &c. Pop. (1920), 137,780.

Screamer, the name of two South American birds, the horned screamer (q.v.) and the crested screamer (*Chauna cristata*).

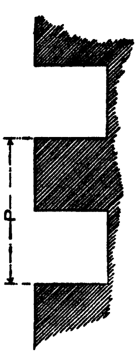
Screw. The first attempt to secure uniformity in the construction of screw threads was made by Sir Joseph Whitworth in 1841. The Whitworth thread was adopted in Britain, but in America the Sellers thread, which was introduced twenty-three years later, replaced it, and is now in general use. The metric thread was introduced by Delisle of Carlsruhe in 1873, and is in common use on the European continent. The dimensions and forms of the threads are shown in the figures, P being the pitch.



Whitworth Thread



Sellers Thread



Square Thread

The screw is extensively used in engineering work in presses, jacks for lifting purposes, adjusting devices on machines, and in measuring-instruments. As a lifting device the screw is simply an inclined plane, and it is consequently easy to determine the mechanical advantage obtained with it. In one revolution of the screw the load will be lifted by an amount equal to the pitch of the screw. Usually the screw is turned by means of some type of lever device. If the radius of the lever is r, the work done upon the screw each revolution, by the application of a force P at the end of the lever, will be $P2\pi r$, and this, if friction is neglected, will equal the work done by the screw, that is, Wp where W is the load and p is the pitch of the screw.

The leading screws of lathes and those in use in instruments are constructed with great accuracy of dimension. The gauging of screws for instrument work has always presented a great deal of difficulty, which has been removed by the use of the optical projection of shadows of the threads. The threads in use in micrometer gauges (see *Tolerance*) must be made within very small limits of accuracy.

Screw threads are cut in a variety of ways: by the use of the leading screw of a lathe; by the use of a tool with a cutting edge formed as a series of teeth, and known as a comb; by the use of taps and dies (see *Tools*); or by special cutters in a milling-machine.

In a lathe the slide-rest may be connected to the leading screw in front of the machine (see *Machine Tools*), and so receive a travel the magnitude of which is fixed by the pitch and speed of running of the leading screw. As the bolt in the chuck of the lathe is revolved, the tool will be moved along so as to cut a thread on the shank. As the relative speeds of the job and the leading screw may be varied at will by the use of speed-changing wheels, it is possible to cut screws of many sizes with the use of a single standard leading screw. Small screws are usually manufactured in automatic machines, where the operations of turning down the end of a bar, forming the threads, cutting off the screw produced, and the feeding-in of the bar succeed each other.

Screw-pine (*Pandănus utilis*)

Screw-pine (Pandănus), a tree or bush, type of the nat. ord. Pandanaceæ. They are natives of tropical regions, and abound in the Eastern Archipelago. They branch in a dichotomous or forked manner, and are remarkable for the aerial or adventitious roots they send out from the stem. The seeds are edible; and the flowers of some species are fragrant, as in the *Pandănus odoratissimus.*

Screw-propeller, the device by means of which the greater number of ships and motorboats are driven. The principle of its operation is that of the common screw.

The first patent for such a device was granted to an Englishman named Lyttleton in 1794 for his 'aquatic propeller', which was provided with threads on a cylinder, like an ordinary screw. Colonel John Stevens demonstrated the possibilities of screw propulsion by its use on a small boat in American waters, but the credit for the successful application of the method is due to Sir F. P. Smith and Ericsson, a Swedish engineer settled in England, who both took out patents for propellers about 1836. A common arrangement is the provision of two separate propellers, one on each side of the stern. The blades may be two, three, or four in number. What is perhaps the most common type has three blades. The forward thrust which the rotation of the blades produces on the propeller shaft is taken directly by a *thrust block* fixed in the structure of the ship. The old type of thrust block provided a series of collars, against which similar stepped parts of the shaft pressed. The modern thrust-block arrangement is due to Michell, and makes use of film-friction actions. The stern tube, through which the propeller shaft passes, is amply provided with packing to prevent the water entering the vessel. Bronze, especially phosphor bronze, is favoured for the construction of propeller blades rather than iron or steel, not only because a considerable reduction (something of the order of 25 per cent) in the weight is obtained, but also because of the increased speed procured for any given power, through a reduction in the necessary scantlings for the support of the propeller shaft, and also because of the greater smoothness of the blades.

Scribe (skrēb), Augustin Eugène, French dramatic writer, born in Paris 1791, died 1861. His first distinct success was achieved in 1816 with *Une nuit de la garde nationale*, and thenceforward his pen was never idle. Alone or in collaboration with other writers he produced over 400 plays. Two of the best known among them, after the first successful one, are *Le Verre d'eau* and *Adrienne Lecouvreur.* As an opera librettist Scribe is also deservedly famous, having supplied several composers, especially Auber and Meyerbeer, with the text of the most celebrated of their works.

Scribes, a term applied originally in the Bible to writers and secretaries, people who knew how to write, but later on, after the return from captivity, to a class of learned men who copied and interpreted the law in the Jewish synagogue. They were thus teachers of the law, and ecclesiastical lawyers, editing the law, expounding and teaching it. As a class of teachers (Gr. *grammateus*, man of letters) they came into existence with Ezra (who is described as the *scribe*, *Ezra*, vii, 21) and lasted until the times of Simon the Just. They were connected with the Pharisees (q.v.), being the leaders of the party, the teachers and theologians (*Matt.* xxiii, 2–34); but some scribes were Sadducees. Their political power was never great, although they frequently sat in the Sanhedrin, and in the New Testament (*Mark*, xii, 38–40; *Luke*, xx, 46) are accused of being ambitious. After Simon the Just the term applied to the teachers of the law was *elders.*

Scrof′ula is tuberculosis of the lymph glands of the body. As a rule its course is milder and more chronic than tuberculosis of other parts, and though it may occur at any age, it is much more common in childhood than at any other time of life. Practically everyone is exposed to the infection, and it depends on whether local conditions are favourable or otherwise if the tubercle bacillus is to get a lodgment or not. A special predisposing cause is catarrh of the mucous surfaces, as seen in chronic nasopharyngeal catarrh and long-standing unhealthy tonsils. Further predisposing causes are the wasting diseases of childhood, whooping-cough, measles, and gastro-enteritis, and these are frequently followed by tuberculosis of the glands of the neck, chest, or abdomen. Rare cases have occurred where all the lymph glands of the body are affected, but usually one group only is attacked, and in children it is most frequently the glands of the neck that are affected—cervical adenitis. The next most frequently attacked region is the abdomen, and tuberculous affection of the glands in that region is known as tabes mesenterica. The glands at first enlarge, and can be felt as hard masses. Later they become soft, and in time the skin on the surface breaks down and ulceration takes place, with a purulent discharge. Sooner or later, if attended to, the ulcerated surface heals, leaving a permanent scar, but as long as there is active ulceration in progress there is always danger of the local condition giving rise to acute tuberculosis. Frequently at the stage of enlargement of the glands the tuberculous infection is overcome, with the result that the swelling subsides without the appearance of any ulceration. When a gland has broken down and is discharging, secondary infection by other organism is of common occurrence, and this infection delays the healing process to a considerable extent. Beyond local treatment, preventive measures against tuberculosis (q.v.) should be maintained.

Scrophularia'ceæ, a very large natural order of herbaceous or shrubby gamopetalous dicotyledons, inhabiting all parts of the world except the coldest. They have opposite or alternate entire toothed or cut leaves, and usually four- or five-lobed irregular flowers with didynamous stamens, placed in axillary or terminal racemes; with a two-celled ovary and albuminous seeds. Many of the genera, such as the foxglove, calceolaria, veronica, mimulus, antirrhinum, pentstemon, &c., have beautiful flowers.

Scudéry (skū-dā-rē), Madeleine de, French romance writer, born in 1607, died in 1701. She became one of the most conspicuous figures in the literary circle of the Hôtel Rambouillet at Paris, and acquired great fame by her romances, *Artamène ou le Grand Cyrus*, *Ibrahim ou l'Illustre Bassa*, *Clélie*, *Almahide*, and others of almost interminable length, almost entirely forgotten now, even by name.

Sculpture, the art of carving or modelling in the round or in relief, the materials usually employed being stone, marble, clay, metal, or wood. The almost invariable preliminary to the production of a piece of sculpture is the making of a model in clay, generally built up round a kind of iron skeleton called an *armature*. This model may itself be baked, to produce a work in terra-cotta; or used to form a mould from which clay reproductions are taken, which are then baked. Otherwise, from the model a plaster of Paris mould is made, from which a plaster cast is taken. This the sculptor copies in his selected material, as a rule with the help of a *pointing machine*, by means of which a series of points are marked in the material, corresponding to a series placed on the model. Sometimes, however, the sculptor works direct, a procedure which calls for a high degree of skill and certainty. In the case of metal, either a mould in sand or clay is prepared from the model, in which the metal is cast and finished by chiselling, or the *cire perdue* process is used. In this a model rather smaller than the size desired is prepared, which is covered with wax, which the sculptor works into the required form. Over this a mixture of clays is placed, and the whole heated, so that the wax runs out through holes left for the purpose. Into the hollow thus left between the inner and the outer core of clay the metal is poured, and when cool the mould is broken away. This method was much used by the sculptors of the Italian Renaissance, and requires little subsequent work on the metal. In making bas-reliefs, similar methods are employed. In these, a useful distinction, often forgotten, is between *basso*, *mezzo*, and *alto relievo*, to express different degrees of projection.

Egyptian Sculpture

Two of the four statues, 65 feet high, of Rameses II, before the rock-hewn Temple of Abu Simbel, Nubia About 1359 B.C.

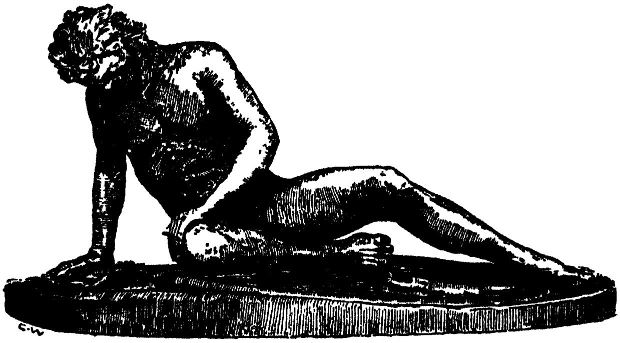
As an art, sculpture reached maturity earlier than painting. Its development in ancient Egypt was somewhat retarded by traditional restrictions imposed by religious and social usage; but by the side of a conventional official art existed a naturalistic type of portraiture, of which admirable examples survive. What little remains of predynastic sculpture is very primitive; but numerous reliefs and some portrait-statues of the earlier dynasties (about 3500–2500 B.C.), though still archaic, unite with the dignity which always marks Egyptian work, a vitality too often stifled by convention in later times. A check due to a period of political unrest was followed by a group of masterpieces produced under the Middle Kingdom (about 2000–1700 B.C.). Another revival took place under the New Empire (1580–1090 B.C.), marked by the production of many colossal portrait-statues, often impressive, but mechanical and conventional. Thenceforward, despite recurring vitality in the field of portraiture, repetition of traditional types is the rule, and persists until the earlier years of the Christian era, despite successive modifications due to Persian, Greek, and Roman conquests. In Mesopotamia the earliest

sculpture has considerable affinity to the contemporary primitive work of Egypt; but about 8000 B.C., with the establishment of Semitic rule, a more naturalistic art developed, wherein Semitic figures appear and a characteristic treatment of drapery. Examples of later periods are rare, until in Assyria, about the ninth century B.C., came a revival represented mainly by a magnificent series of bas-reliefs, wherein the treatment of animals is singularly vigorous. Sculpture in the round, such as the famous winged bulls, was also produced, but was treated essentially as a bas-relief intended to be seen from one or two points of view only. Persian sculpture mainly carried on Assyrian traditions, whose influence is also seen in the work of the Hittites, Phrygians, Lydians, and Carians in Asia Minor. Meanwhile in Crete, under Mesopotamian and Egyptian influence, an art of a more graceful and charming type had developed, which through its offshoot at Mycenæ (represented by the well-known Lion Gate and the Vaphio Cups, dating from about 1400 B.C.) laid the foundations of Greek art. The earliest manifestations of this were in Ionia, where the characteristics which were later to mark Greek art are mingled with Oriental influences; in the Cyclades; and in the Peloponnesus, where growing skill in handling the nude male form is well seen in a series of statues of Apollo, culminating in the *Apollo of Piombino* (now in the Louvre). Broadly, this period saw the development from a primitive sculpture which was primarily decorative to a tolerably naturalistic treatment of the human figure in the round. Meanwhile, in Sicily, the metopes of the Temple of Selinus show an effort at producing more complicated compositions. The gap between this more primitive work and the masterpieces of the fifth century is filled by the sculpture from the Temple at Ægina (480 B.C., now in Munich), and that from the Temple of Zeus at Olympia (about 460 B.C.), which belong to the Peloponnesian school. In these, not only are the individual figures full of character and vigour, despite the survival of archaic details, but they are combined into subtle and harmonious compositions. Other admirable examples of this transition period are the Ludovisi relief of *Hera* (Museo delle Terme, Rome), and the *Charioteer of Delphi*, possibly by the Attic sculptor Calamis. With these begins the supremacy of the Argive and Attic schools, and the great period of Greek art. The first dominant figure is Myron, who worked in the first half of the fifth century, and is best known by his *Discobolos*, in which his power of rendering the human figure in action and his rather dry handling is well seen. His younger contemporary Polyclitus was head of the Argive school, whose work centred round representation of the athletic male form. Characteristic in their solid compactness and detailed modelling are his *Doryphorus* and *Diadumenos*, which embody the famous canon of Polyclitus as to the proportions of the human figure. But it is with Pheidias that the finest work of fifth-century Greece is connected. To him no existing work can with certainty be ascribed; but he is the chief personality behind the sculpture of the Parthenon, of which the greater part is in the British Museum. Here in the highest degree are the dignified simplicity of conception, the ideal generalized types, reflecting nevertheless profound study of nature, and the technical accomplishment, which distinguish the art of the period. In the fourth century, however, sculpture becomes the vehicle for expressing the passions and moods of the individual artist; types are more strongly characterized; and much technical resource is lavished in surface modelling and treatment of texture. These tendencies are revealed in the work of Praxiteles, whose *Hermes* is remarkable for its graceful pose and the easy flow of its modelling; while his *Aphrodite of Cnidos* is less a goddess than a woman conscious of her nudity. The massive types of his Doric contemporary Scopas have something in common with the work of Polyclitus, but possess an emotional intensity of their own admirably seen in the *Demeter of Cnidos*, and in those portions of the sculpture of the mausoleum of Halicarnassus for which Scopas was responsible.

Arēs at Rest

A copy of a statue by Scopas or Lysippus

Towards the end of the century exaggeration of this emotional tendency, in figures more slender in type with small heads, marks the work of Lysippus, sculptor to Alexander the Great. He is the last great sculptor of Greece proper, whose traditions are thenceforward chiefly carried on in Asia Minor and Alexandria until the Roman conquest. This Hellenistic work shows great technical skill, picturesque conception, and dramatic vigour, well seen in the sculpture of Pergamon and Rhodes, which includes the well-known figures of Dying Gauls and the famous Laocoon group. Typical of this period also is a group of strongly characterized portraits. In Italy, before the Christian era, Greek influence was strong, and Roman sculpture is dominated by Greek ideas and methods. Its individual character appears in the subordination of the figure to general decorative effect, as in the series of historical bas-reliefs on the altars, arches, and columns erected to celebrate the victories of the emperors. In subject these bas-reliefs recall those of Egypt and Assyria, and in treatment show a growing tendency towards pictorial quality and expression of space and atmosphere. Roman sculpture is also represented by some strongly realistic portraits of the Republican age, which were succeeded by the more idealized but still vigorous busts of the Imperial age. These and the bas-reliefs supplied motives for early Christian sculpture, consisting mainly of bas-reliefs which mingled Hellenic and Eastern elements in the treatment of Biblical subjects, the finest being those produced in the Byzantine Empire. Elsewhere Byzantine influence combined with Gothic from the north. The latter predominates in the sculpture of Celtic and Scandinavian countries, which consists mainly of geometrical and abstract ornament; and it plays an important part in the eleventh and twelfth century Romanesque art of France and England. Romanesque leads into Gothic sculpture, which attained its highest development in thirteenth-century France. The prime function of this is to decorate the objects expressive of the mystical religious temper of the age, from great cathedrals such as Chartres and Amiens to the ivory carvings used in private devotions. Individual statues are frequently of admirable quality; but the mediæval artist did not shrink from deliberate distortions or variations in proportion, to bring every part into a unified whole. The nude figure is rarely used, and drapery plays an important part in design. At the same time, the treatment of figures and ornament is intensely naturalistic, a love of caricature and of the grotesque finding frequent expression. In the fourteenth century comes decline, with mannerism, search for picturesqueness, and loss of monumental quality. Gothic sculpture in Italy, represented by such notable work as the pulpits at Pisa and Siena by Niccola Pisano, shows strongly the influence of Roman art, and paves the way to the sculpture of the Renaissance in the fifteenth century. In this period, as in classical antiquity, the nude human form treated in the round becomes the chief interest of sculptors, thus reflecting the outlook of the age, which, in contrast to mediæval ideas, made man the



The Dying Gaul. Statue in the Capitoline Museum, Rome

Gilt Bronze Statue of King Arthur by Peter Vischer, at Innsbruck central figure of the universe. Renaissance sculpture found its chief home in Florence; and of its earlier representatives, Ghiberti still retains many Gothic characteristics in his best-known work, the bronze doors of the Baptistery at Florence. Donatello, however, combines Gothic realism with truly classic treatment, notably in his impressive equestrian statue of Gattamelata at Padua, and in his singing-gallery for Florence Cathedral. Luca Della Robbia, best known for his glazed terra-cotta figures, also produced important work in marble and bronze, notably a companion singing-gallery to that of Donatello, less vigorous but full of grace and charm. Mino da Fiesole, Michelozzo, Benedetto da Maiano, and Rosellino are other sculptors of the period who mingle with their classicism a playfulness and love of delicate detail characteristic of the fifteenth century. In the work of Michelangelo, such as the Medici tombs at Florence, and the *Moses* at Rome (part of the unfinished tomb of Julius II), not only does the spirit of the Renaissance find complete expression, but that of a succeeding age is foreshadowed in the exaggerated size and muscularity of his figures, and in his calculated distortions, marks of a highly subjective art which separate it from that of fifth-century Greece. Similar tendencies are discernible in the more graceful work of his contemporary Sansovino; and even more in that of his follower Giovanni da Bologna, who prepared the way for the baroque sculpture of the seventeenth century. This found its most brilliant exponent in Bernini, whose superb technical accomplishment served an art extravagantly dramatic and emotional, aiming at pictorial rather than sculpturesque quality. His influence was widespread, and found its chief field in France. Here Renaissance sculpture, represented by Jean Goujon and Germain Pilon, had retained much Gothic character. It was followed by the work of a seventeenth-century group of sculptors, including Girardon, Coysevox, and Puget, who modified the extravagances of Bernini into an art dignified and imposing, but apt to become pompous and turgid. The eighteenth century saw the modification of the baroque into the rococo, wherein grace and elegance are the qualities chiefly sought, and which is exemplified by the work of Bouchardon, Pigalle, Falconet, and Clodion. The monumental tradition is not, however, entirely lost; and in Houdon France produced an admirable sculptor of portrait-busts, which combine strong characterization with simple and dignified design. His sitters included not only the chief figures in contemporary France, but a number of distinguished Americans, among them Washington and Franklin. Towards the end of the century came the neo-classic movement, with Italy as its centre, which produced sculpture free from rococo eccentricities, but dull, academic, and lifeless. Characteristic is the work of Canova and Thorwaldsen in Italy, of Chaudet and Pradier in France, and of Flaxman and Chantrey in England. The revolt against this art came with the Romantic movement of the early nineteenth century, and is seen in the work of Rude and Carpeaux in France, and of Alfred Stevens in England, emotional in conception and vigorous in treatment. The revival was continued by the work of Barye and Dalou, who pave the way to Rodin. His highly subjective art combines realism with free distortion and exaggeration in the interests of design and emotional expression. He is one of the chief influences in such modern sculpture as that of Bourdelle in France and of Epstein in England. In a modified form the classic tradition survives in the work of Sicard and Mailloe in France, and in that of Havard Thomas in England. Another influence of importance in modern art is that of primitive and negro sculpture, seen in the work of the Serbian Mestrovíc, and in an extreme form in that of Matisse and Gaudier-Brzeska. — BIBLIOGRAPHY: E. Short, *History of Sculpture*; Perrot and Chipiez, *Histoire de l'art dans l'antiquité*;

The Tomb of Richelieu, by Girardon, in the Church of the Sorbonne, Paris

Flinders Petrie, *Arts and Crafts of Ancient Egypt*; E. Gardner, *Handbook of Greek Sculpture*; G. Dickins, *Hellenistic Sculpture*; E. Strong, *Roman Sculpture*; E. Mâle, *L'Art du XIII^e Siècle*; W. Bode, *Florentine Sculptors of the Renaissance*; Franscetti, *Bernini*; Hart and Biddle, *Houdon*; C. Taft, *Modern Tendencies in Sculpture.*

Scunthorpe, an urban district of Lincolnshire, England. There are iron- and steel-works. Pop. 27,400.

Scurvy is a disease produced by the absence in the dietary of certain elements contained in fresh food, especially vegetable food. It is now a rare disease in adults, but is frequently seen in infants (infantile scurvy). Various theories have been held as to the cause, but the symptoms are so definitely relieved by any fresh vegetable food, fruit, or vegetable juice, that the disease must be considered to be due to the absence of an accessory food substance (vitamin). The early symptoms are languor and pallor with marked loss of appetite, and associated with these, swollen spongy gums, which bleed easily and allow the teeth to become loose. Later there appears swelling of the legs, roughness of the skin, with many small hæmorrhages under its surface, and various changes of vision. Along with these there is marked general weakness. Infantile scurvy arises practically always in children fed on patent and proprietary foods. If no fresh vegetable food is given, the patient in time shows an extreme degree of weakness and anæmia, and death is frequently hastened by such complications as diarrhœa and pneumonia. On the other hand, the addition of some form of fresh vegetable food, or juice, to the diet produces a marked improvement on the patient within two days. In the navy and merchant service, lemon juice is employed, and its use has led to the disappearance of the disease in these services.

Scurvy-grass (*Cochlearia officinālis*), a cruciferous plant, growing in Britain and elsewhere on the sea-shore and high up on the mountains. It has long been esteemed for its antiscorbutic property.

Scu'tari, or **Uskudur** (ancient **Chrysopolis**), a town of Asia Minor, on the Bosporus, opposite Constantinople, of which it is a suburb. It contains numerous mosques, fine bazaars, baths, and the enormous barracks of Selim III, which are associated with the name of Florence Nightingale. Scutari has manufactures of saddlery, silk, muslin, and cotton stuffs. Pop. 100,000.

Scu'tari, or **Skodra**, a town of Albania, at the south end of the lake of the same name. It has manufactures of inlaid arms, saltpetre, and wine. Pop. 32,000.

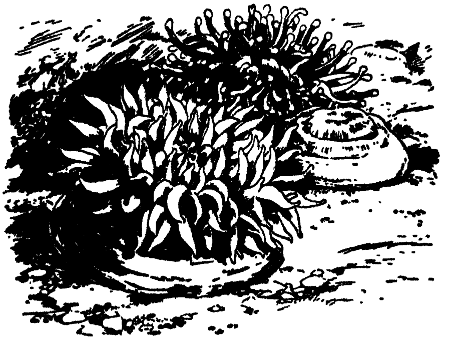
Scylla, a rock in the Strait of Messina, on the Italian side nearly opposite the whirlpool of Charybdis. Various legends were associated with Scylla and Charybdis, which were considered highly dangerous to navigators. See *Charybdis.*

Scyphozoa, a group of animals forming in some classifications a sub-division of the phylum Cœlenterata. This phylum is divided by some authorities into the classes Hydrozoa and Actinozoa; by others into Hydrozoa, Scyphozoa, Actinozoa, and Ctenophora; and by others still into Hydromedusæ, Scyphozoa, and Ctenophora. Distinctive characters of the Scyphozoa are usually taken to be the stomodæum, or ingrowth of ectoderm forming an œsophagus; endodermal gastric tentacles; and endodermal sexual cells.

Scythe, an instrument used in mowing or reaping, consisting of a long curved blade with a sharp edge, made fast at a proper angle to the lower end of a long handle, snath, or snead, which is bent into a convenient form for swinging the blade to advantage, and has generally two short projecting handles fixed to the principal handle, by which it is held. For laying cut corn evenly, a *cradle*, as it is called, may be used. One form of scythe has a short branching handle somewhat in the shape of the letter Y, having two small handles fixed at the extremities of the two branches at right angles to the plane in which they lie. The Hainault scythe is a scythe used with only one hand, straggling corn being hooked up with one hand and cut with the other.

Scyth'rops, the channel-bill, a genus of birds of the cuckoo family. Only one species is known, the *S. novæ hollandiæ*, a very handsome bird inhabiting part of Australia, Papuasia, and the Moluccas, about the size of the common crow. It has a large and curiously formed beak.

Sea-anemone, the popular name given to a number of animals of the phylum Cœlenterata and class Anthozoa, including the genus Actinia and many other genera. They are among the most interesting organisms met with on the sea-beach, or in aquaria. All sea-anemones, however varied in coloration or form, present the essential



Sea-anemones

structure and appearance of a fleshy cylinder, attached by its base to a rock or stone, and presenting at its free extremity the mouth, surrounded by circlets of tentacles. With these tentacles, which may be very numerous, in some cases exceeding 200 in number, they seize and secure their food—small crustacea, molluscs, such as whelks, &c.—which they paralyse by means of the thread-cells common to them with all Cœlenterata. The mouth leads into a gullet that hangs down into a cavity divided into compartments by radiating partitions. When fully expanded, anemones in their varieties of colour are exceedingly beautiful. But upon the slightest touch the tentacles can be quickly retracted within the mouth-aperture, the fluids of the body are expelled by the mouth, and the animal, from presenting the appearance of a fully expanded flower, becomes a conical mass of jelly-like matter. Although these forms are attached to rocks and fixed objects, they appear able to detach themselves at will. Some are commensal with hermit-crabs, being attached to the shells inhabited by these crustaceans. Anemones are diœcious, that is, having the sexes situated in different individuals. The eggs are either fertilized in the surrounding sea-water or within the parent, and appear in their embryo state as free-swimming ciliated bodies of an oval shape. The sea-anemones resemble the Hydræ in their marvellous powers of resisting injuries and mutilation. Thus if a sea-anemone be divided longitudinally, a new animal will in due time be formed out of each half.

Sea-dragon (*Pegăsus draco*), a small teleostean fish found in Indian seas. The breast is very wide, and the large wing-like pectoral fins, together with its general appearance, have procured for this fish its popular name. The Chinese *P. volans* is very similar. *P. natans*, an allied species from Australian waters, has smaller pectoral fins and a larger body. The dragonets are also known as sea-dragons.

Sea-eagle, a name applied to one or two members of the eagle family; but especially to the cinereous or white-tailed eagle or erne (*Haliaëtus albicilla*), occurring in most parts of the Old World. The bird breeds in Shetland and in the Hebrides. Its average size appears to be about 3 feet in length, and from 6 to 7 feet in expanse of wings. The American bald-headed eagle (*H. leucocephalus*) is also sometimes named the sea-eagle. See *Eagle.*

Seaham Harbour, a seaport of England, in the county of Durham, with an excellent harbour for the shipping of coal. Pop. 17,000.

Sea-hare (Aplysia), the name of a genus of hind-gilled sea-snails, slug-like in appearance, and with a prominent front pair of tentacles. The shell is a curved plate almost entirely covered by a fold of skin. Four tentacles exist, and the eyes are situated at the base of the hinder pair. The sea-hares are widely distributed, and generally inhabit muddy or sandy tracts. They emit a fluid of a rich purple hue. *A. hybrida* is the common British species.

Sea-kale (*Crambe maritima*), a perennial cruciferous herb, a species of colewort, called also *sea-cabbage.* It is a native of the sea-coasts of Europe, and is much cultivated in England as a table vegetable, the blanched young shoots and leaf-stalks being the parts eaten.

Seal, the name applied collectively to certain genera of mammals, order Carnivora, section Pinnipedia or Pinnigrada, in which the extremities are modified into swimming-paddles. Two distinct families are defined, the Phocidæ—common or true seals, and the Otariidæ—eared seals or sea-lions.

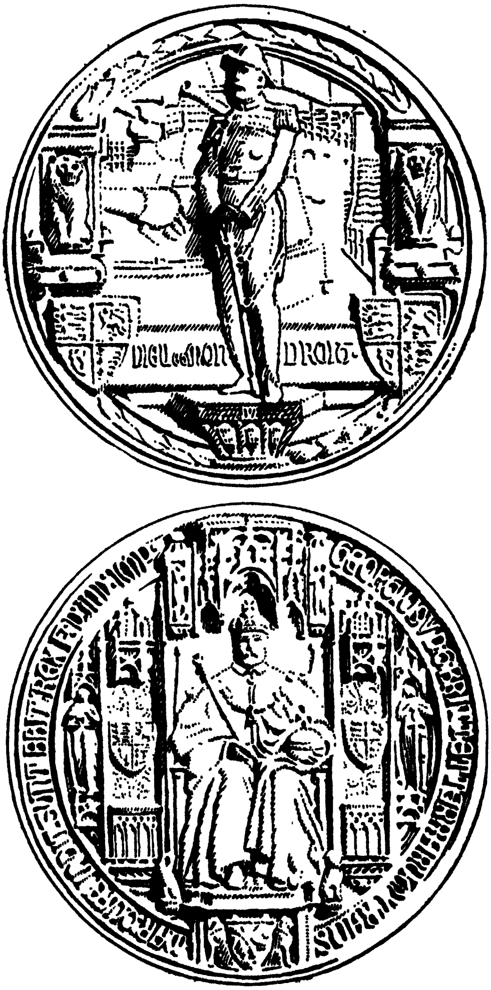
Seals. Common Seal (*Phoca vitulina*), behind which is the Fur Seal (*Otaria ursina*). Harp or Greenland Seal (*Phoca grœnlandica*) in background.

The Phocidæ, or true or hair seals, have a body of fish-like contour. They have no external ear, and the hind limbs are permanently stretched out behind the body and parallel with the tail. There are five toes on each foot, and the middle digits of the hinder feet are much shorter than the outer ones. The toes, which are provided with claw-like nails, are united by a web of skin. The fore limbs are mere flippers. The back teeth are flattened and sharply pointed, and are all much alike. The fur generally consists of a dense thick under-fur and of an outer coat of longer and coarser hairs. The bones are of light spongy texture, and beneath the skin is a thick layer of blubber or fat. The eyes are large and intelligent, and the sense of smell is also well developed. The brain is large in proportion to the body, and, when domesticated, seals exhibit a very high degree of intelligence. They are apparently monogamous, and seldom produce more than two at a birth, one being the rule. They occur in almost all non-tropical seas, but are most plentiful in high latitudes. They are hunted for their skins, which are converted into leather (much used in the manufacture of school-bags), and for their blubber, from which oil is obtained. The common seal (*Phoca vitulīna*) is found widely in northern regions, and also on the more northern coasts of Britain. Its average length is from 3 to 5 feet, and the fur is a greyish-brown, mottled with black. It is very destructive to most of the food fishes. It is much attached to its young, and is strongly attracted by musical sounds. It is never met with in large numbers, or far away from the land. The harp seal, Greenland seal, saddleback, or atak (*P. grœnlandica*), inhabits the Arctic Ocean. The males average 5 feet in length. In the spring, at breeding season, these seals resort in immense herds to the floes of the Arctic Ocean, around Jan Mayen Island, where great numbers of them are killed annually by crews of the sealing vessels. The great seal (*P. barbāta*), which is 8 or 10 feet in length, occurs in Southern Greenland. The grey seal (*Halichœrus grypus* or *griseus*) is from 8 to 9 feet long, and is found on the Scandinavian and Icelandic coasts. The *Phoca caspica*, found in the Caspian Sea, attains a length of about 5 feet. The Baikal seal (*P. sibirica*) is a very similar species. The monk seal (*Monachus albiventer*) of the Mediterranean and Black Seas seems to have been the seal best known to the ancients. To the same genus belongs the West Indian seal (*M. tropicalis*). The genus Cystophŏra includes the large bladder-nose, hooded or crested seal (*C. cristāta*) of the Greenland seas. The largest of the pinnipeds is the sea-elephant or elephant-seal (q.v.).

The Otariidæ or 'eared' seals are distinguished by the possession of a small outer ear, a longer neck, better developed limbs, and a much nearer affinity to the bears. The northern sea-lion (*Otaria stelleri*), so called from its mane of stiff crisp hairs, is a native of both the American and the Asiatic shores of the North Pacific. The southern sea-lion (*O. jubata*) belongs to South America. Among the species of fur-seals in the southern hemisphere are the Falkland Island seal, the Cape seal, and the New Zealand seal. The best known among fur-seals is the northern fur-seal, which breeds on the islands of the Pribylov group, off the coast of Alaska, and at the Commander Islands, in Behring's Sea. The species found here is *Callorhīnus ursīnus* or *Otaria ursīna*. It makes its appearance from the southward late in the spring, leaving again about the end of October or beginning of November. Each old male mates with ten or fifteen or more females, whom he guards jealously, and on whose behalf he fights furiously. The female gives birth to one pup. The male attains maturity about the eighth year, when its length is from 7 to 8 feet, and its weight from 500 to 700 lb. The outer and longer hairs of its fur are of a greyish-brown colour, the thicker under-fur being darker or reddish-brown; and it is this fine under-fur which, when stripped of the coarse outer hairs and dressed by the furrier, affords one of the most beautiful and valued of the 'sealskins' of commerce.

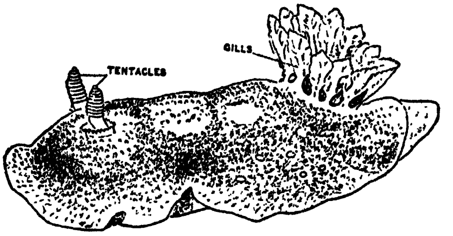
The seal fisheries are divided into hair-seal fisheries and fur-seal fisheries. The principal seats of the hair-seal fishery are Newfoundland, Jan Mayen, and the Caspian Sea. British ports engaged in the industry are Dundee and Peterhead. Steamers are employed, and the vessels make the ice about the middle of March, and prosecute the seal fishing till about the middle of May, when they proceed to the whale fishing. The seals are taken either by clubbing them or shooting them on the ice. The species taken are the harp or saddle-back and the hood or bladder-nose. The skins are salted, and the fat is stowed into tanks, and manufactured into oil when the vessels reach home in the autumn. The blubber of about 100 seals yields a tun of oil. A 'close season' has now been established both in the Newfoundland fishery and the Jan Mayen fishery. The fur-seal fishery is carried on chiefly at the Pribylov Islands. The United States claimed the right to prohibit sealing in Behring's Sea, a claim which led to difficulties with Britain, and the case was decided against them by arbitration, except as regards the three-mile limit. By a treaty signed in 1911 the Federal Government was given the sole right to kill seals in Behring's Sea or on the islands, and agreed to hand over a proportion of the catch to Great Britain and Japan, 15 per cent to each.

Seal. A seal upon a document was originally a substitute for a signature; a seal upon a place of deposit answered the purpose of security in a different manner from a lock. The use of seals is of the highest antiquity, and one of the earliest and commonest forms is the signet-ring. In Egypt impressions of seals were made in fine clay, and attached to documents by slips of papyri. The Romans used clay, bees'-wax, and in the time of the Empire lead for taking impressions. In the time of Constantine flat metal seals called *bullæ* were used. The metals used were gold, silver, and lead, and the bullæ were attached to documents by silk or woollen bands. The leaden seal was adopted by the Popes. (See *Bull.*) The Western monarchs generally used bullæ up to the sixteenth century. The use of bees'-wax was introduced by the Normans; sealing-wax was invented in the seventeenth century. Documents in England are still sealed in compliance with legal formality, but the true voucher to which alone any real importance attaches is the signature. There are three seals officially used in England by or in name of the sovereign—the great seal, the privy seal, and the signet. There is a similar set of seals for Scotland, which are only used for private rights and grants connected with that part of the kingdom.



Obverse and Reverse of the Great Seal of George V. Actual size 6¼ in. diameter. The inscription reads: GEORGIUS V D: G: BRITT: ET TERRARUM TRANS MAR: QUÆ INDIT: SUNT BRIT: REX F: D: IND: IMP.

Sea-lemon (Doris), a genus of sea-slugs, the type of the family Dorididæ. It is destitute of a shell, and moves by means of a broad ventral foot. The gills exist in the form of a circle of plumes surrounding the vent near the hind end of the upper surface. They can be retracted at will within the body. Sea-lemons may be found at low-water mark under stones and in similar situations. *Doris tuberculata*, or the 'sea-lemon' *par excellence*, is about 3 inches in length, of a yellow colour, and has a corrugated skin.



Sea-lemon

Sealing-wax, a resinous preparation used for securing folded papers and envelopes, and for receiving impressions of seals. Ordinary red sealing-wax is made of pure bleached lac, to which when melted are added Venice turpentine and vermilion. Inferior qualities consist of a proportion of common resin and red lead, and black and other colours are produced by substituting appropriate pigments. Sealing-wax was invented in the seventeenth century.

Sealkote, or Sialkot, a town of India, in the Punjab, 72 miles north-east of Lahore, is the scene of a famous annual fair, and a local trade centre of rising importance. The manufactures are paper and cloth. Pop. 65,000.

Seamanship, the practical work of taking a ship from port to port or of boat-sailing. Seamanship and navigation are not synonymous terms; on the contrary they are diametrically opposed, for navigation, or a good knowledge of it, may be acquired in places utterly remote from the sea, while seamanship itself is purely a result of experience, either gained personally or confided to one by another. It is quite common, but not quite true, to say that 'seamanship does not now exist' although certainly there can be no comparison between modern triumphs of engineering and the mastery over nature for which man waged a victorious battle in bygone days with little other aid than canvas, wood, and hemp. The essential difference between the seamanship of the old days and that of the new is not one of degree but of kind. Under the careful eye of her master the wooden ship, her tall, canvas-laden masts raking the skies, sailed all over and across the Seven Seas, just as the mechanical leviathans are doing at the present day; but still there is no comparison. The sailing-ship master works his ship in the highest sense of the term, for he is on deck, where all the necessary operations of seamanship are performed at his direction; he knows every sail and every spar, and he gives shape to his orders as necessity arises; dependent entirely upon his own seamanship and the efficiency of his officers and men in performing definite operations, for keeping his ship upon its course, and avoiding difficulties of all kinds as they arise or are foreseen. In the steamship, however, all this work is expressible in terms of so much mechanism. The master is the navigator; he has gongs, speaking-tubes, wireless direction- and time-signals, steam-steering, steam or internal-combustion propulsion, and a host of ingenious devices; but they are all under the direction of engineers and mechanics, and the master, with neither sail nor spar to trouble him, and only a handful of levers to operate, becomes more of a refined mathematician and a skilful navigator, and rather less of a coarse, rough-and-ready, blustering seaman of the old school.

R. H. Dana, the author of *Two Years Before the Mast*, writing in 1844 says:

> The common saying that to hand, reef and steer makes a sailor, is a mistake. It is true that no man is a sailor until he can do these things; yet to ship for an able seaman he must, in addition to these, be a good workman upon rigging. The rigging of a ship requires constant working upon in a multitude of ways; and whenever any of the ropes or yards are chafing or wearing upon it, it must be protected by "chafing gear". This chafing gear consists of worming, parcelling, serving, rounding, &c.; which requires a constant supply of small stuffs, such as foxes, sennit, spunyarn, marline, and the like, all which is made on board from condemned rigging and old junk. There is also a good deal of new rigging to be cut and fitted on board, which requires neat knots, splices, seizings, coverings and turnings in. It is also frequently necessary to set up the rigging in one part of the vessel or another; in which case it must be seized or turned in afresh. It is upon labour of this kind that the crew is employed in the "day's work" and jobs which are constantly carried forward on board. *A man's skill in this work is the chief test of his seamanship*: a competent knowledge of steering, reefing, furling, and the like may be taken for granted as no more than what is expected of an ordinary seaman; *but to put a marlinspike in a man's hand and set him to work upon a piece of rigging, is considered a fair trial of his qualities as an able seaman.*

In the article *Sail* some idea of the multiplicity of the spars and cordage involved in the yards and running rigging of the old-fashioned sailing-ship—now disparagingly termed a *wind-jammer*—may be gained; and when it is considered, that to work upon a sail a seaman must first know the name of it, and then he must know the spar it is bent to before he can hope to find it, the need for a lengthy apprenticeship and an almost incredible amount of highly specialized knowledge becomes at once apparent. Nowadays there are few spars and few sails, and the bulk of merchant shipping, dependent solely upon steam, possesses hollow masting made of steel plates. Hempen rope has given place to steel hawse, even in the few remaining sailing-ships, and the profession of the sea, though no easier than it used to be, has benefited much from scientific improvement by the elimination of a great deal of unnecessary labour and hardship, and especially by the substantial shortening of sailing-times between ports.

From the very earliest times until the first voyage of Columbus (1492) ships 'hugged the shore', unless an exception be made of those Irish who colonized Iceland, and the Norsemen who visited Greenland, and (according to Dr. Fridtjof Nansen, q.v.) Labrador. Columbus began a new era in which navigation began slowly to develop, and, beginning as a mere auxiliary to perfect seamanship, it has gradually drawn level and is even now considered by many to be of more importance. It is a battle between theory and practice in which neither of the forces can be supplanted by the other. Practical seamanship is indebted to theory for a reasonably straight course and the avoidance of mishap; given the course, the practical part of the business is to keep the ship to it, and this, of course, is the business of modern seamanship. The task of working a ship has fewer terrors and less drudgery under steam than under sail, and it is more certain withal, for the work is divided between two departments, deck and engines, where there was formerly only one, and weather conditions, &c., have been more or less eliminated as factors of uncertainty.

In the days of the sailing-ship, textbooks of seamanship were essential, but nowadays they are not so necessary and those that do exist are more dictionaries than anything else—dictionaries of mechanics with appendices on sail. Two volumes are published for the Admiralty—*Manual of Seamanship*.

Sea-mat, or Hornwrack (Flustra), a genus of the phylum Polyzoa (q.v.). The sea-mat looks like a piece of pale-brown sea-weed. *F. foliacea*, or the broad hornwrack, is a familiar species. The sea-mat is a compound organism, produced by a process of continuous gemmation or budding from a single original polype, which latter was in turn developed from a true egg. Each little polype or zooid possesses a mouth surrounded by a crown or circle of retractile, ciliated tentacles, a digestive tube, and a nervous ganglion.

Sea-mouse (Aphrodītē), a genus of Annelids or segmented marine worms. Beautiful iridescent hues are exhibited by the hairs or bristles which fringe the sides of the body. The sea-mouse inhabits deep water, and may be obtained by dredging, although it is frequently cast up on shores after storms. The common species

(*A. aculeata*) of the British and French coasts is 6 or 8 inches long and 2 or 3 inches in width.

Sea-pink (*Armeria maritima*), a small plant, the type of the genus Armeria, nat. ord. Plumbaginaceæ. It is found on all the coasts of Britain, and on many of the mountains. In gardens it is often used as an edging for borders in place of box.

Sea-power, a term which, though often believed to be of quite modern origin, was, in the form of 'power of the sea', employed by a writer of the time of Henry VI. Sea-power has been important at all times, and, with but few exceptions, to all countries of any standing. A reference to the writings of Thucydides shows him to have been as fully alive to the importance of sea-power as are Mahan and other writers of his school to-day. In the Persian wars sea-power was a deciding factor, as is shown by the overwhelming victory of Greece at Salamis. The struggle for supremacy waged by Rome against Carthage soon convinced the former nation that a powerful naval force was absolutely necessary for victory. A superb example of sea-power is afforded by the Vikings of the eighth and ninth centuries, who, in spite of their relatively small numbers, raided and plundered practically all Europe. Their mobility, and the entire absence of anything approaching a navy among the civilized nations of that time, made the Northmen's raids irresistible. When, under Saladin, the Saracens began to neglect maritime enterprise, their power declined. Venice, Genoa, and Pisa alike owed their rise and long-continued wealth to power on the sea; Genoa declined after her defeat by the Venetians at Chioggia. The dawn of Britain's sea-power is usually considered as dating from the defeat of the Spanish Armada in 1588; though as early as 1340 Edward III's victory over the French fleet at Sluys was as decisive as the later triumph of Trafalgar in relieving Great Britain from fears of invasion. The struggles with the Dutch, and the enterprise of Cromwell in the capture of Jamaica (1664) are most important items in the story of our growing power on the sea. Napoleon, supreme as a commander upon land, was, in spite of ceaseless energy and constant and minute attention to the question of his navy, never able to attain complete success at sea. The American Civil War, in which the navy of the North was able to blockade effectively the Southern ports; the success of Japan against China in the last decade of the nineteenth century; the Russian defeat at the hands of Japan; and the still more recent events of the European War, are all examples of the never-ceasing need for nations who desire to remain 'Great Powers' to secure command at sea. The introduction of under-sea command and, through air-craft, of power above the sea has resulted in a considerable modification of the fundamental principles of sea-power as popularized by Mahan, and the exact function of this power in wars of the future cannot readily be defined. See *Navy*.—BIBLIOGRAPHY: A. T. Mahan, *Influence of Sea Power upon History (1660–1783)*; *Life of Nelson*; W. O. Stevens and A. F. Westcott, *A History of Sea Power*; J. A. Froude, *English Seamen in the Sixteenth Century*.

Search-light, a powerful light which is used in combination with a suitable reflector to obtain a parallel beam, and is put to useful service in the navigation of narrow channels, for the detection of ships at sea and air-craft, and for signalling. Parabolic reflectors are used to obtain the parallel beam of light, and in those cases where a divergent beam is required the conditions are met by moving the source of light out of the focus of the reflector, or by using dispersion lenses or divergers. The dispersion lenses are designed to produce a cone of light which is very useful for aerial reconnaissance work. For surface observations the diverger, which spreads the light horizontally, meets the conditions most satisfactorily.

The source of light is commonly a carbon arc, with the carbons set horizontally and provided with series and shunt coils to regulate the arc. The currents in use vary from as low as 30 amperes in small search-lights up to about 200 amperes in the largest sizes.

Sea-robin (*Trigla cucŭlus*), a British acanthopterous fish, otherwise called the *Red* or *Cuckoo Gurnard*. It is about a foot long, and of a beautiful bright-red colour. In the United States the name is given to a species of the kindred genus Prionōtus.

Sea Rocket (*Cakile maritima*), a cruciferous herb with fleshy leaves and lilac flowers, common on sandy shores.

Sea-serpents. Stories of the occasional appearance on the surface of the sea of serpents of gigantic size were long regarded as mere 'travellers' tales', retailed by ignorant sailors and unworthy of serious attention. Many such stories doubtless rested on no better basis than a school of porpoises, a pair of basking sharks, a flock of water-birds, or a long mass of drifting weed. But it is impossible to dismiss in such summary fashion the account given by the officers of H.M.S. *Dædalus*, who sighted and observed with care some immense unknown creature off the coast of Africa in 1848; or the observations of those on board the Royal yacht *Osborne*, who enjoyed a like experience while cruising near Sicily in 1877. That some gigantic specimens of squid exist is quite well known; and the late Philip Henry Gosse is not the only eminent scientist to admit the possible survival and occasional emergence from remote ocean depths of some wellnigh extinct plesiosaurus.—Cf. Lee, *Sea Monsters Unmasked* (*International Fisheries Exhibition Handbook*, 1883).

Seashore, or **Foreshore,** in law, signifies the strip surrounding a coast between high- and low-water mark. The foreshore is vested in the Crown or in a subject by grant from the Crown. The public may walk on any part vested in the Crown and may fish there, but there is no right of access over private lands adjoining the foreshore.

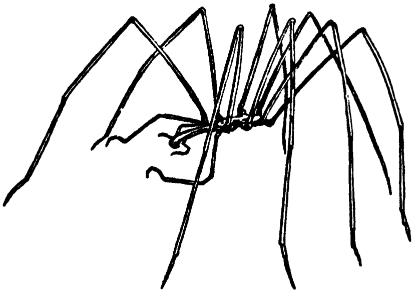
Sea-sickness is caused by the abnormal stimulation of the semicircular canals in the internal ear, and produces, by reflex action, nausea, vomiting, and depression. The degree of sea-sickness varies from slight nausea and lassitude to extreme vomiting and collapse. A few persons are insusceptible; with many, after a few days' sailing, the condition passes away; while some persons are affected always. The likelihood of sea-sickness is increased by such secondary causes as the diet taken before setting off and when on board, the depressing influence of cold, and the position of the person with regard to the rolling of the ship or with regard to smells and other external discomforts. On the other hand, its prevention can be furthered by light regular diet and avoidance of constipation, by warmth, by lying down, and especially by lying down in darkness or with the eyes shut. Many substances have been used as preventives, sometimes with success—coffee, bromides, chloral, opium, amyl nitrite, and various proprietary medicines. As curative measures during an attack, rest and warmth, with small doses of brandy and ice, or champagne in frequent small quantities, are the most effective.

Seaside Grape, a small tree of the genus Coccoloba (*C. uvifera*), nat. ord. Polygonaceæ, which grows on the sea-coasts of Florida and the West Indies. It has clusters of edible fruit like currants, and a beautiful hard wood which produces a red dye; and it yields the extract known as *Jamaica kino.*

Sea-snake, a name common to a family of snakes, Hydridæ, of several genera, as Hydrus, Pelamis, Chersydrus, &c. They are found off the coast of Africa, and are plentiful in the Indian Archipelago. They are all, so far as known, exceedingly venomous. The *Hydrus Stokesii* inhabits the Australian seas, and is as thick as a man's thigh.

Seasons, the four quarters into which the year is divided, according to the general character of the weather. Such a division of the year is more applicable to the higher latitudes. Within the tropics there is comparatively little variation in the solar heat received and the length of the day, and a division of the year into a wet and a dry season is in many cases the most suitable. In northern latitudes January is, in general, the coldest month and July the warmest. Therefore both for ordinary and meteorological purposes winter is generally held to include December, January, and February, and summer to include June, July, and August, while the intervening quarters constitute spring and autumn. What is called the astronomical division of the seasons places them about three weeks later, making winter and summer commence at the solstices, spring and autumn at the equinoxes. In southern latitudes, of course, the corresponding seasons occur six months later (or earlier) than in the northern. See *Spring*; *Summer*; *Autumn*; *Winter*; *Climate*; *Earth*; *Equinox.*

Sea-spider, or **Spider-crab,** a marine crab of the genus Maia (*M. squinado*), with a body of triangular shape, and long legs. It lives in deep water.



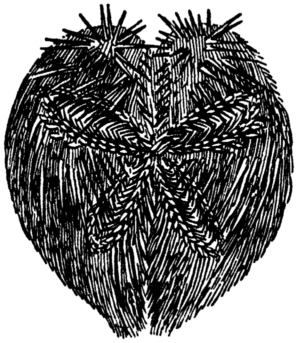
Deep-sea Spider

Sea-surgeon, or **Surgeon-fish** (*Acanthūrus chirurgus*), a spiny-finned fish so named from the presence of a sharp erectile spine on each side of the tail near its tip. When erected they are formidable weapons. This fish occurs on the Atlantic coasts of South America and Africa, and in the Caribbean seas. Its average length is from 12 to 19 inches. These fishes make themselves inconspicuous by attaching bits of seaweed and other objects to their backs.

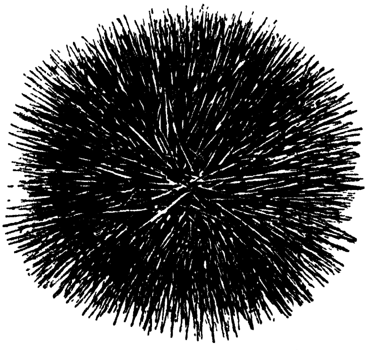
Sea-toad, a name given to certain spider-crabs (*Hyas araneus*) found on British coasts at low-water mark.

Seattle, a seaport-city of Washington, United States, the largest city, state-capital, and county seat of King county, on Seattle Bay. Steamship communication is maintained with Alaska and British Columbia (Prince Rupert), and with trans-Pacific and Pacific coastal towns. At Seattle is Puget Sound Navy Yard, protected by a fort. Manufactures include canned meats, canned fish, foundry and machine-shop goods (bolts and nuts especially), confectionery, and ships. There is an export of wheat, flour, hay, potatoes, timber, live-stock, fruit, &c., and coffee, rice, silks, &c., are imported. Pop. (1920), 815,000.

Sea-urchin, a name often used as equivalent to *echinus* (q.v.), a genus of Echinodermata (q.v.), marine animals allied to the starfishes and sea-cucumbers. The skin of the animal is covered with prickles, resembling somewhat those of the common urchin or hedgehog. The name sea-urchin is also applied in a looser sense to a number of other genera of echinoderms besides echinus. A distinction has been drawn between a *regular* and an *irregular* type. In the former the test is spheroidal, with the mouth at the lower pole and the anus at the upper. To this type belongs *Echinus esculentus*, the familiar edible species. In the irregular type, the test is oval or heart-shaped, with the mouth at the front and the anus behind. This type includes the heart-urchins, sand-dollars, and shield-urchins.



Upper side of a Heart-urchin (*Spatangus purpureus*)



Sea-urchin (*Echinus lividus*)

Sea-urchins live on the sea bottom at all depths, or among rocks. Some, like the sand-dollars, bury themselves in the sand; others, like the purple sea-urchin, by some process not yet understood, bore holes in rock and fix themselves there.

Sea-water, the salt water of the sea or ocean. Sea-water contains chlorides and sulphates of sodium (chloride of sodium = common salt), magnesium, and potassium, together with bromides and carbonates, chiefly of potassium and calcium. The dissolved salts amount to about 3·5 per cent of the weight of a given quantity of sea-water, sodium chloride being by far the most abundant constituent. Sea-water is in consequence somewhat denser than river-water; but the rivers that bring dissolved material from the land-surface are regarded as the primary sources of the saltness of the sea.

Sea-weed. See *Algæ.*

Sea-wolf (*Anarrhichas lupus*), a genus of spiny-finned teleostean fishes, family Blenniidæ or blennies (also known by the names 'sea-cat' and 'swine-fish'). Its mouth is armed with sharp, strong teeth of large size, and when captured it is said to bite the nets and even attack the fishermen. Around the coasts of Britain it attains a length of 5 or 6 feet. The flesh is palatable, and is eaten in Iceland, whilst the skin is durable, and is manufactured into a kind of *shagreen*, used for making pouches and like articles. See *Bass.*

Seba′ceous Glands are small glands situated in the deeper layers of the true skin, and have ducts which open into the upper portion of the hair follicles. They secrete a fatty matter, called sebum, which acts as a lubricant to the hairs. They are found generally over the body surface, but are most abundant on the scalp.

Sebas′tes, a genus of spiny-finned fishes, containing the bergylt or Norway haddock (*S. norvegicus*), which is viviparous. See *Bergylt.*

Sebas′tian, Dom, King of Portugal, posthumous son of the Infant John and of Joanna, daughter of Charles V, born in 1554, died in 1578, ascended the throne in 1557, at the death of his grandfather, John III. In 1578 he led the flower of his nobility into Africa on a wild expedition against the Moors, and perished in battle with nearly all his followers. He had no immediate heir, and many Portuguese refused to believe in his death. Several pretenders appeared, and Sebastianism, or the belief in the return of the king, lingered long in Portugal.

Sebastian, St., Christian martyr, born at Narbonne about 255, died 288. Under Diocletian he was captain of the prætorian guard at Rome, and rose to high favour at court. Having declared himself a Christian, and refused to abjure, he was tied to a tree and pierced with arrows. A Christian woman named Irene, who came by night to inter his body, finding signs of life in him, took him home, and nursed him till he recovered. He then presented himself before Diocletian, and remonstrated with him on his cruelty; whereupon the emperor ordered him to be beaten to death with rods, and his body to be thrown into the *cloaca*. His protection was invoked against pestilence, and his martyrdom has been a favourite subject in Christian art.

Sebas'topol, or Sevastopol, a Russian town and naval station on the Black Sea, in the south-west of the Crimea. It has grown up since 1780, when it was a mere Tatar village. On the outbreak of the Crimean War, when the population amounted to 43,000, it became the point against which the operations of the Allies were mainly directed, and its siege was a deciding factor in the campaign. The town, then utterly destroyed, was reconstructed, and though the Treaty of Paris stipulated that no arsenal should exist on the Black Sea, and that the town should not again be fortified, these restrictions were abrogated in 1871. Feodosia (Theodosia) is more important commercially. In Nov., 1920, Sebastopol was captured by the Bolshevists. Pop. 77,000.

Sebes'ten, the *Cordia myxa* and *latifolia*, Asiatic trees of the borage order. The fruit is edible, and in India is pickled, and also used as a demulcent.

Secamo'ne, a genus of plants, mostly climbing shrubs, nat. ord. Asclepiadaceæ, found in the warm parts of India, Africa, and Australia. The roots of *S. emetica* are employed as a substitute for ipecacuanha.

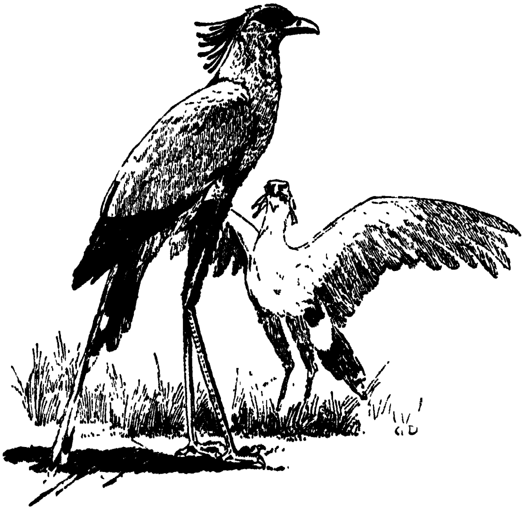
Secondary Cell, an electric cell which has the characteristic that after it has been discharged it can be charged afresh from any suitable source of power. The chemical changes in a primary battery lead to the elements being consumed, but in a secondary cell the chemical changes are reversible. In a simple lead accumulator the positive plate is composed of lead peroxide, and the negative plate is made of lead in a spongy and chemically active form. The electrolyte used is dilute sulphuric acid. In the Planté process of accumulator manufacture the positive plate is formed from pure lead, which is later converted into the peroxide. In the Faure process grids of lead are filled with the active material in the form of paste. When a cell is discharged, the active material is changed to sulphate of lead, which is converted back to the original substances on the passage through the cell of a current from a generator. The chemical changes are somewhat intricate. Through the production of water from the sulphuric acid as lead sulphate is formed during the discharge, the density of the acid is reduced. When charging, the density of the acid is increased, and the specific gravity of the electrolyte is a good index to the state of charge of the battery. The electrolyte should be made up from chemically pure sulphuric acid and distilled water. The density changes from 1·19 originally to about 1·21 when the battery is fully charged, and about 1·16 when discharged. The electromotive force of a cell rises rapidly towards the end of the charging process, and on discharge the pressure falls rapidly to an average of about 1·9 volts, but afterwards very slowly. Such cells should never be discharged beyond the point when the voltage of the cells is 1·8. Batteries are rated by their capacity in ampere hours at a specified time rate. A battery of 40 ampere hours on the ten-hour rate will give 4 amperes steady discharge for ten hours, and will then have a voltage of about 1·8 per cell, and will need recharging. Of the ampere hours expended in charging, a good secondary cell will give back about 90 to 95 per cent during discharge.

In Edison's cell, which is much used in electric vehicles, the active materials are iron and nickel plates immersed in a solution of caustic potash. A lead cell requires attention and frequent charging to prevent deterioration, even though it is not in active use, but the Edison type is entirely free from this trouble. The ampere-hour efficiency of an Edison cell is about 10 to 15 per cent lower than that of the lead type.

Secondary Growth, or Secondary Thickening, in plants, the increase in girth of stems and roots, due to the activity of the cambium (q.v.). It occurs more or less in all dicotyledonous Angiosperms and in Conifers, but is most marked in perennial stems and roots, especially in those which are woody. It is found also, though in a modified form, in certain arborescent Monocotyledons (e.g. Dracæna, Yucca, Palms), and, though rare—and even when present feeble—in living Ferns and Fern-allies, was a prominent feature of many extinct Pteridophytes (Calamites, Lepidodendreæ, &c.). The object of secondary thickening is the provision of additional vascular (conducting), mechanical (strengthening), and storage tissue, so as to keep pace with the ever-increasing surface and bulk of a perennial plant-body.

Second Sight (in Gael. *taisch*), a Highland superstition, formerly very common, which supposed certain persons endowed with the power of seeing future or distant events as if actually present. These visions were believed to be not as a rule voluntary, but rather dreaded than otherwise by those who were subject to them; yet it was also believed that those who possessed this gift might sometimes induce visions by the performance of certain awful rites. Some of the Scottish seers declared this power to be hereditary, whilst others maintained that they could impart the gift of second sight by teaching. The subject is treated at length in Martin's *Description of the Western Isles of Scotland* (1703); Macleod of Hamir's *Treatise on the Second Sight* (1763); and is discussed also in Dr. Johnson's *Journey to the Hebrides* (1775).

Secretary-bird, the sole representative of the genus Serpentarius (*S. secretarius*), order Falconiformes or diurnal birds of prey. It derives its popular name from the peculiar plumes of feathers which project from the back and sides of its head, and give it the appearance of having bundles of pens stuck behind each ear. It has very long legs, and stands nearly 4 feet in height. The wings are elongated, and carry a blunt spur on the shoulder. The tail is also very long. The skin around the eyes is destitute of feathers. The general colour is a slaty grey. The secretary-bird can fly with ease when once it takes wing, but it seems to prefer the ground. It is found over the greater part of Africa, especially in the south. It derives its generic name from its habits of destroying serpents, striking them with its knobbed wings and kicking forward at them with its feet until they are stunned, and then swallowing them. It also feeds on lizards, tortoises, birds, small mammals, and insects. As a foe to venomous snakes it is encouraged and protected in South Africa, where it is frequently brought up tame.



Secretary-birds (*Serpentarius secretarius*)

Secretary of State, an officer whose business is to superintend and manage the affairs of a particular department of government. There are connected with the British Government six secretaries of state, who are members of the Cabinet, viz. those for home, foreign, and colonial affairs, and those for war, India, and Scotland. (See *Home Office*; *War Office*.) The *colonial secretary* is head of the Colonial Office, and performs for the colonial dependencies similar functions to those of the foreign secretary for foreign countries. He appoints the governors of the Crown colonies and supervises their administration. Each secretary of state is assisted by two under-secretaries, one permanent, the other parliamentary, the latter retiring with the ministry. For a time the head of the air ministry ranked as a secretary of state, but in 1918 was subordinated to the secretary for war. The *minister of munitions*, appointed in 1915, ranked as a secretary of state. From 1707 to 1746 there was a secretary of state for Scotland. In 1885 the office of *secretary for Scotland* was revived; he was as a rule in the Cabinet, but in 1926 he again became a secretary of state, and therefore now holds Cabinet rank by virtue of his office. The *secretary to the Admiralty* is a subordinate member of the Government, always a member of the House of Commons, in which he represents the Admiralty when the first lord of the Admiralty is a peer. A *secretary of embassy*, or of *legation*, is the principal assistant of an ambassador or envoy.

Secretion, in animal physiology, is the separation of certain elements of the blood, and their elaboration to form special fluids, differing from the blood itself or from any of its constituents, as bile, saliva, mucus, urine, &c. Secretion is performed by organs of various form and structure, but the most general are those called glands. Of these glands the essentially active parts are the cells, which elaborate from the blood a peculiar fluid in each instance predetermined by the inherent function of the gland or organ of which the cells are integral parts. The chief general conditions which variously affect secretion are the quantity and quality of the blood traversing the gland and the influence of the nervous system. Secretions are divided into (1) external and (2) internal. *External secretions* are carried away through tubes or ducts either directly to the exterior, as in the case of perspiration, or into the cavity of some internal organ, instances of this being afforded by saliva, gastric juice, urine, &c. The last-named, being a waste product, can also be termed an *excretion*. *Internal secretions* when elaborated are absorbed into the blood and carried to various parts of the body. Some of them are produced by the ductless glands, such as thyroid, suprarenals, and pituitary body; while others are elaborated by the generative glands, the pancreas, and the epithelial lining of the small intestine. Extracts containing internal secretions are much used in modern medicine.

Secretion, in vegetable physiology, is the separation of certain compounds from the sap, and their elaboration by particular organs. These secretions are exceedingly numerous, and constitute the great bulk of the solid parts of plants. They have been divided into (1) *general* or *nutritious secretions*, the component parts of which are gum, sugar, starch, cellulose, lignin, albumen, and gluten; and (2) *special* or *non-assimilable secretions*, which may be arranged under the heads of acids, alkalies, neutral principles, resinous principles, colouring-matters, latex, oils, &c. Carnivorous plants secrete a fluid resembling gastric juice, for the purpose of digesting their prey.

Secular Games, a great festival, probably of Etruscan origin, anciently celebrated at Rome to mark the commencement of a new *sæculum* or generation. They were celebrated at very irregular intervals.

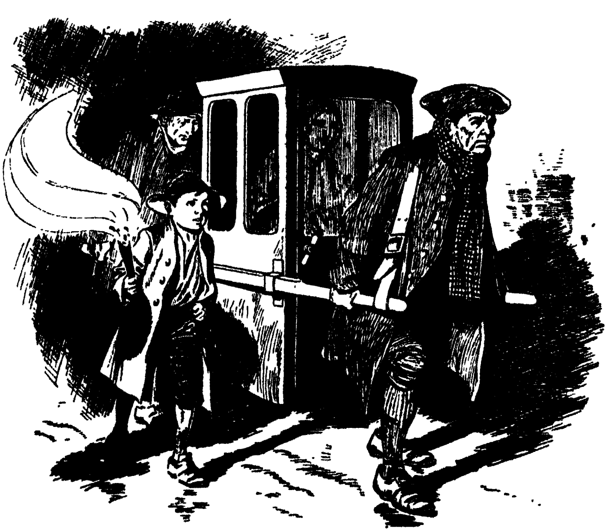
Secularism, a term applied to a social and ethical system advocated about 1846 by G. J. Holyoake (1817–1906). Secularism, which may be said to have been influenced by positivism (q.v.), as it bears traces of utilitarianism and antitheism, is really agnostic in its tendencies, as it neither denies nor affirms the truth of religion. Secularism does not deny the existence of a God, but it maintains that He is not concerned with, and does not concern, material existence. Concentrating its attention upon present life, it seeks to improve the human lot by material means only, means which are proximate and attainable, leaving the future life to take care of itself. A society was formed in London of which Holyoake was president, being succeeded by Charles Bradlaugh in 1858. Holyoake defined secularism as follows: "Secularism is that which seeks the development of the physical, moral, and intellectual nature of man to the highest possible point, as the immediate duty of life, which inculcates the practical sufficiency of natural morality apart from Atheism, Theism, or the Bible, which selects as its methods of procedure the promotion of human improvement by material means." The origin of secularism, like that of many other modern movements, was due to social wrongs and the suffering of the lower classes. It came into existence after the failure of the Chartist movement in England and after the Revolutions of 1848 on the Continent.—Bibliography: G. J. Holyoake, *Principles of Secularism*; *The Origin and Nature of Secularism*; J. M'Cabe, *Life and Letters of G. J. Holyoake*; R. Flint, *Anti-Theistic Theories.*

Security, in its legal significance, may bear many meanings. The most common are: (1) something given or deposited to make certain the fulfilment of a promise or obligation, the payment of a debt, or the like, such as a mortgage, or a pawnbroking pledge; (2) a 'security for money', or 'money security', is a document or transaction by which the payment or recovery of money is assured, such as bills of exchange, cheques, promissory notes, bank-notes, exchequer bills, stock in the funds, &c. Shares in public companies are often known as 'securities', though technically they are not 'securities for money'. Securities or 'sureties' are often required, in cases of assault, &c., for good behaviour, or to ensure the defendant coming up for judgment when or if required.

Sedaine (sė-dān), Michel Jean, French dramatist, born 1719, died 1797. Among his comedies are *Le Philosophe sans le savoir* and *La Gageure imprévue.*

Sedan, a town of France, in the department of Ardennes, on the Meuse. The staple industry is the manufacture of fine black cloth. At Sedan, on 2nd Sept., 1870, Napoleon III and the entire army of Marshal MacMahon surrendered to the Germans (Franco-German War, q.v.). Pop. 20,000.

Sedan′, or **Sedan-chair**, a covered chair for carrying one person, borne on poles by two men, and differing from the litter or palanquin in that the passenger sat instead of reclining. It is said to have taken its name from the town of Sedan, in France. It was introduced into England in 1634, and was very fashionable during the reigns of Anne and the early Georges, but disappeared at the beginning of the nineteenth century, on the introduction of the cab.



Sedan-chair

Se′datives, medicines that moderate the excessive action of an organ or organic system. Digitalis, for example, is a sedative of the action of the heart and the circulatory system; and gum-resins are sedatives that act on the nervous system. Besides these, aconite, chloroform, conium, carbonic acid, and prussic acid are among the principal sedatives.

Sedbergh, a market town of England, West Riding of Yorkshire, on the River Rawthey, 14 miles west of Hawes. The grammar-school was founded in 1528, and refounded in 1551 by Edward VI; it now ranks among the important public schools. Pop. 4004.

Sedge (Carex; nat. ord. Cyperaceæ), an extensive genus of grass-like plants, containing thousands of species, mostly inhabiting the northern and temperate parts of the globe. Most of the species are marsh plants. The stems are usually triangular, without joints. The decomposed roots and leaves contribute largely to turn the soil of marshes into peat.

True Sedge

Sedgemoor, a marshy tract in Somersetshire, England, about 5 miles south-east of Bridgewater. In 1685 it was the scene of the battle in which the Duke of Monmouth was defeated by the troops of James II.

Sedge-warbler (*Acrocephalus phragmitis*), a species of perching bird of the warbler subfamily (Sylviinæ) of the thrush family (Turdidæ), which frequents the sedgy banks of rivers, visiting Britain about the middle of April and migrating in September.

Sedgley, an urban district of Staffordshire, England, near Wolverhampton; served by the London & North-Western Railway. It has extensive collieries and ironworks, with manufactures of rivets, nails, chains, fire-irons, locks, safes, &c. Pop. 17,200.

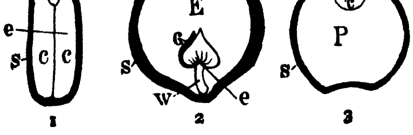
Sedgwick, Adam, British geologist, born in 1785, died in 1873. He was educated at Sedbergh and Trinity College, Cambridge, and in 1818 was appointed Woodwardian professor of geology in his own university; he held this chair till within a short time of his death. His chief services to geology consisted in the determination of the geological relations of the Palæozoic strata of Devon and Cornwall, and of those strata afterwards called Permian in the north-east and north-west of England, and in the explanation of the geological character of North Wales (see *Geology*).—Cf. Sir A. Geikie, *The Founders of Geology.*

Sedimentary Rocks, rocks which have been formed by materials deposited from suspension in water or in air, or in some cases from solution. Examples of these three types are clay, wind-borne sand, and travertine.

Sedition, a term including all offences against the Crown and Government which do not amount to treason, and are not capital, as libels, meetings, conspiracies, and other practices calculated unlawfully to subvert the established Constitution, to bring hatred or contempt upon the sovereign or Government, to raise disaffection among subjects, or to promote ill-feeling between class and class. Practically, sedition is treason without the element of overt action. The punishment of sedition in Great Britain, formerly arbitrary, is now restricted to fine and imprisonment.

Sedley, Sir Charles, one of the 'wits' of the Restoration period, and a great favourite with Charles II, born in 1639, died in 1701. His first comedy, *The Mulberry Garden*, was published in 1668, but is now forgotten; the only piece of Sedley's work which is widely known is his song *Phyllis is my only joy.*

Sedum, a genus of plants, nat. ord. Crassulaceæ. It comprises about 120 species, mostly perennial herbs, erect or prostrate, with succulent leaves, and with flowers usually cymose, and of a white, yellow, or pink colour. They are natives of north temperate and cold regions, and are often found on rocks, walls, and dry banks, where nothing else will grow. Some of the British species are *S. telephium* and *S. album* (white stonecrop), eaten cooked or as a salad, and *S. acre* (biting stonecrop or wall-pepper). Many foreign species are cultivated in British gardens.



Sections of Seeds

1, Exalbuminous seed. 2, With endosperm E. 3, With endosperm E and perisperm P. S, Testa. *e*, Embryo. *c*, Cotyledons. W, Radicle.

Seed, the ovule (q.v.) of a flowering plant, as modified by fertilization. Its essential parts are an *embryo*, derived from the fertilized ovum, and a protective seed-coat or *testa*, derived from the integuments. The embryo consists of a primary root or *radicle*, a primary shoot or *plumule*, and one (monocotyledons), two (dicotyledons), or several (many Gymnosperms) seed-leaves or *cotyledons*, and is therefore a miniature plant in a dormant state; for its development into a seedling, at the proper time, a store of food-material is provided, deposited either within the embryo itself (usually in the cotyledons), in *exalbuminous* seeds, or in a special nutritive tissue, the *endosperm*, adjoining or surrounding the embryo, in *albuminous* seeds. Sometimes the testa is furnished with appendages which help in the dispersal of the seed, such as the hairs of cotton, willow, &c., or the fleshy outgrowths called *arils* and *caruncles*. See *Botany*; *Cotyledons*; *Embryo*; *Endosperm*; *Dispersal of Seeds and Fruits*.

Seed-habit, in plants, a term used to denote the possession of true seeds, as opposed to spores. It is a further development from heterospory (q.v.). See *Seed-plants*.

Seed-plants, or **Spermatophyta**, a common name for the Angiosperms and Gymnosperms, which alone among living plant-groups have genuine seeds. The seed-habit existed also in the extinct class of Pteridosperms, and seed-like organs are found in certain fossil Lycopods (Lepidodendreæ).

Seeley, Sir John Robert, British historian, born in 1834, died in 1895. Educated at the City of London School and at Christ's College, Cambridge, he graduated as senior classic, and was first chancellor's medallist. In 1863 he was appointed professor of Latin in University College, London; and in 1869 he succeeded Charles Kingsley in the chair of modern history at Cambridge. In 1865 appeared a work, *Ecce Homo, or the Life and Work of Jesus Christ*, published anonymously but afterwards acknowledged by the author. It created a profound sensation at the time of its appearance; but *Natural Religion* (1882) attracted much less attention. Among his other works are *The Expansion of England* and *The Growth of British Policy*.

Segovia, a province of Central Spain, mainly an elevated plateau sloping from the Guadarrama range, which forms the southern boundary. Agriculture is the chief industry; the Guadarrama is afforested, and there also granite, limestone, and marble are found. Segovia (pop. 14,000) is the capital and the only large town. Provincial area, 2635 sq. miles; pop. 170,820.

Seine (ancient **Sequăna**), a river of France, which rises on the slopes of the Plateau de Langres, in the department of Côte-d'Or, 20 miles north-west of Dijon. It flows generally in a north-west direction; receives on the right the Aube, Marne, and Oise, and on the left the Yonne and Eure; passes Chatillon, Troyes, Corbeil, Paris, St. Denis, St. Germain, Poissy, Mantes, Elbeuf, Rouen, Quillebœuf, and falls into the English Channel between Honfleur and Le Havre. Its total length is 480 miles, and its basin has an area of about 30,000 sq. miles. It is navigable, and connected by canals with the Loire, Saône, Scheldt, Aisne, Oise, Sambre, Somme, and Rhine. There is a 'bore' of from 8 to 10 feet at every tide; and the estuary, which commences at Quillebœuf, is impeded by sand-banks.

Seine, a department of Northern France, completely enclosed by the department of Seine-et-Oise, and at once the smallest and most populous of the French departments, including as it does the city of Paris. Area, 185 sq. miles; pop. 4,154,000.

Seine. See *Net*.

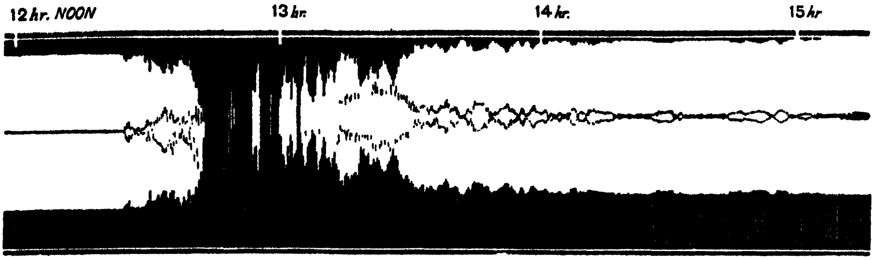
Seine-et-Marne, a department of Northern France, in the basin of the Seine and Marne, east of Seine-et-Oise. Area, 2275 sq. miles; pop. 363,600. Stone, clay, porcelain clay (which supply the potteries of Fontainebleau and Montereau), and many other minerals are produced. Wheat and oats are of special note. The capital is Melun.

Seine-et-Oise, a department of Northern France, in the basin of the Seine and Oise, enclosing the department of Seine. Area, 2184 sq. miles; pop. 817,600. Seine-et-Oise is a great agricultural and horticultural department, producing cereals, sugar-beet, and potatoes. Mineral-springs exist at Forges-les-Bains and Enghien. Industrial manufacturing interests include the national porcelain factory (Sèvres) and State munitions establishments (Sevran and Bouchet). Versailles is the capital.

Seine-Inférieure, a maritime department of Northern France, on the English Channel, mostly north of the estuary of the Seine. Area, 2448 sq. miles; pop. 877,400. Cereals and potatoes are produced; cider is made, and manufacturing industries include cottons (centred at Rouen), woollens (Elbeuf), steel and wooden shipbuilding (Havre, Rouen, Dieppe, and Fécamp), national tobacco factories (Dieppe and Havre), and sugar- and flour-mills, distilleries, &c. Both the Western and the Northern Railways provide communications, but the Western is the principal system. Rouen (the capital), Havre, and Dieppe are the chief ports; other towns are Le Tréport, St. Valéry, Fécamp, and Etretat, all fashionable watering-places.

Seir-fish, or **Seer-fish**, a fish of the mackerel family (*Cybium guttatum*), which occurs in East Indian seas. In size, form, and the flavour of its flesh it bears a close resemblance to the salmon.

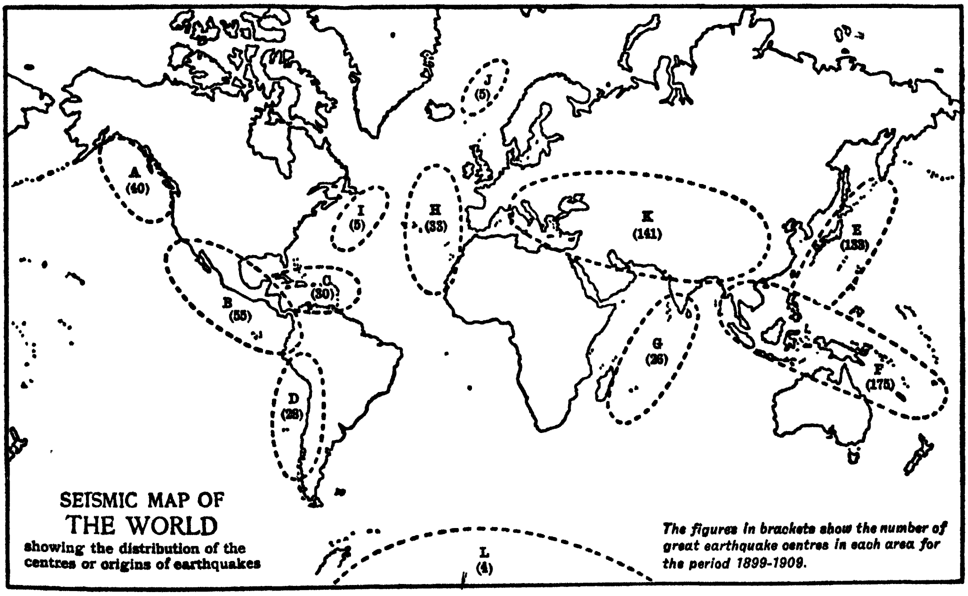
Seismograph, or **Seismometer**, an instrument by which earthquakes are recorded; the name *seismograph* is applied specially to the self-registering type. There are two main classes. (1) In the *steady-point instruments* a heavy mass is fixed upon a movable arm. Owing to the inertia of the mass, the free end of this boom executes movements in a direction contrary to that in which the earth wave displaces the hinge or pivot. (2) In the *goniometers*, or tilt measurers, the tilting of the axis which carries the boom causes the latter to swing from its position of rest. In each case the motion is recorded photographically on sensitized paper. Of the latter class is the Milne seismograph, an inexpensive and largely used instrument. The interval between the arrival of waves of different phases indicates the distance of the origin. Its situation can thus be located from the records of three well-separated stations, or often even of two. With the Galitzin seismograph, one of the steady-point class, it is possible, if there are instruments suitably placed to record vibrations in two vertical planes at right angles, to estimate the locus from records even of one station.



Seismograph Photographic Record. Actual length for 3 hours is 7 inches

By permission of Donald Maclean, F.R.A.S., and the Committee of the Coats Observatory, Paisley.

Seismology (Gr. *seismos*, earthquake, and *logos*, discussion), the science of earthquakes. Many earthquakes are doubtless caused by fractures produced in the earth's crust under strain, forming geological faults, or by further yielding of existing faults. Such fractures can occur in the higher strata, which have been denominated the *zone of fracture*. Beneath this there is supposed to be a *zone of flow*, in which, owing to the higher temperature there existing the material of the rocks would under strain tend to flow like a viscous liquid. There is conclusive evidence that many earthquakes originate near the surface, and it has even been argued that 20 or at most 30 miles is the maximum depth of origin.



SEISMIC MAP OF THE WORLD
showing the distribution of the centres or origins of earthquakes

The figures in brackets show the number of great earthquake centres in each area for the period 1899-1909.

Many regions manifest both high volcanicity and seismicity. But even there the relation is *not intimate. Earthquakes accompanying, and directly caused by, volcanic eruptions are more often of minor intensity, and rarely affect large areas. A theory that earthquakes result from lunar tides in the earth's interior, formerly supposed molten, has been practically abandoned. The moon's influence must at most be very insignificant.*

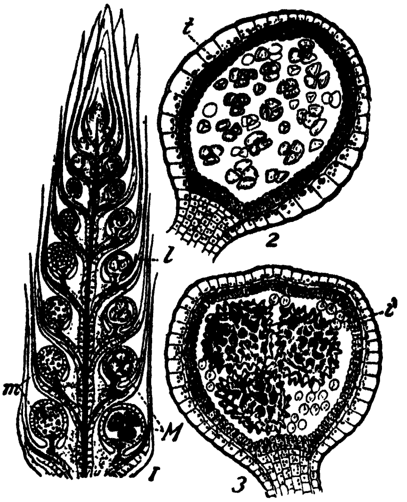
In 1917 Dr. G. W. Walker showed that in order to explain angles of emergence of earthquake waves as observed at Pulkova, the depth of focus must have been some hundreds of miles. Evidence confirming the occasional occurrence of foci of great depths was obtained in 1922 by Professor H. H. Turner from a mathematical investigation of the times of arrival of earthquake waves at the antipodes of the epicentre, employing certain results arrived at by Professor C. G. Knott on the propagation of earthquake waves through the earth. Professor Turner found that in certain cases the probable depth of focus was at least 240 miles. It appears, therefore, that at a sufficient distance beneath the 'zone of flow' the peculiar conditions existing produce such a state of the earth's material that earthquakes may originate there also. See *Earthquake.*

Seistan, an Asiatic basin of internal drainage; area, 7000 sq. miles. Since 1872 it has been divided politically between Persia, whose share amounts to 2840 sq. miles, and Afghanistan, possessing 4160 sq. miles (see *Persia*; note to section *Physiography*). Seistan is, roughly, the region of the lower Helmund River, and its chief feature is the vast Hamun-i-Helmund (or Hamoon), half lake and half swamp, which overflows by the Shelag into the enormous salt swamp Gaud-i-Zirreh, or Shelag Hamun, during seasons of flood. The Hamun receives the drainage of the whole of the Seistan basin, through the Helmund and its tributaries. The region is fairly rich agriculturally, and, given the necessary development, "it would become a second Egypt" (Goldsmid).

Seizin, or **Seisin**, in law, possession of the freehold. Seisin in deed is actual possession; seisin in law is, e.g., when lands descend to an heir but he has not yet entered on them. Change in the form of conveyance and in the rule of descent of land have made seisin (sasine in Scots law) much less important than it was.

Seja'nus, Aelius, a favourite of the Emperor Tiberius. He was commander of the prætorian bands, and aimed at the supreme power. He contrived to remove all the members of the imperial family who stood between him and power, but having awakened the suspicion of Tiberius, he was executed in A.D. 31.

Selaginel'la, a genus of club-mosses, readily distinguished from the genus Lycopodium by their flat two-ranked stem, and by being heterosporous. They are mostly natives of warm climates.



Selaginella

1, Vertical section of a cone (somewhat diagrammatic: *l*, ligule of the bract; *m*, microsporangium; M, megasporangium. 2, Vertical section of a microsporangium; *t*, the nursing-layer (tapetum) of the wall. 3, Vertical section of a megasporangium. A single spore mother-cell has ripened and produced four megaspores (three only are figured). Other spore mother-cells are seen in process of degeneration.

Selangor, one of the Federated Malay States, British Malaya. It belongs mainly to the drainage area of the Klang River. Rubber is the chief product. Klang is the seat of the Sultan. Kuala-Lumpur is the capital, and is also capital of the Federated Malay States; Port Swettenham is a great rubber port. All these towns are connected with the Malayan (Western) railway system. Area, 3156 sq. miles; pop. 294,100.

Selborne, Roundell Palmer, Earl of, British lawyer, was born in 1812, died in 1895. He was called to the Bar in 1837, entered Parliament in 1847, became Solicitor-General in 1861, Attorney-General in 1863, and was Lord Chancellor from 1872 to 1874 and from 1880 to 1885. He was largely responsible for the Judicature Act of 1873, whereby all the higher courts were united into one supreme tribunal.

Selby, an urban district and market town of Yorkshire (West Riding), on the Ouse, which is here navigable for vessels of 200 tons. The magnificent parish church formed part of a Benedictine abbey founded by William the Conqueror. Pop. (1921), 9990.

Selden, John, English jurist, legal antiquary, and Oriental scholar, born 1584, died 1654. Educated at the free grammar-school, Chichester, and at Hart Hall, Oxford, he proceeded to

London to Clement's Inn and the Inner Temple. On being called to the Bar he practised principally as a chamber counsel, devoting his leisure to the study of constitutional history. He published several valuable works, including the *Analecton Anglo-Britannicon*, a treatise on the civil government of Britain before the coming of the Normans; *Janus Anglorum, Facies altera* (1610), a treatise on the progress of English law down to Henry II; and *Titles of Honour* (1614), still a standard authority in regard to all that concerns the degrees of nobility and gentry in England. His *De Diis Syriis* (1617), on Syrian mythology, at once established his fame as an Oriental scholar; and his *History of Tithes* (1618) brought him into collision with the clergy. In 1635 he published his celebrated work *Mare Clausum*. Selden was imprisoned several times on account of his opinions. In 1640 he sat in the Long Parliament for the University of Oxford, and espoused the popular cause, but with great moderation. He sat as a lay member of the Westminster Assembly (1643), was named one of the parliamentary Commissioners of the Admiralty (1645), subscribed the Solemn League and Covenant (1646), and was voted £5000 by Parliament in recompense of his losses and as a reward for his services to the State. His *Table Talk* was published in 1689 by his amanuensis, Richard Milward.—Cf. G. W. Johnson, *Memoirs of John Selden*.

Sele'nê, in Greek mythology, the goddess of the moon, daughter of Hyperion, and sister of Helios (the sun) and Eos (the dawn). She was also called Phœbe, and in later times was identified with Artemis. According to a popular legend, Endymion, her lover, lay sunk in eternal sleep in a cave on Mount Latmos, where he was nightly visited by Selenē. In art she is often represented as a beautiful woman with large wings, a long robe, and a coronet.

Sele'nium, an element (symbol, Se; atomic weight, 79·2) which is fairly widely distributed, but in small quantity. It is usually found associated with metals such as copper, lead, mercury, and iron. The chief source is iron pyrites (FeS_2), in which sulphur is sometimes partially replaced by selenium. Selenium is closely allied to sulphur in its chemical properties, and is usually associated with it. During the manufacture of sulphur dioxide from pyrites any selenium present is transformed into selenium dioxide; this is carried into the lead chambers used in sulphuric acid manufacture, and there it becomes reduced by sulphur dioxide to selenium. Selenium, like sulphur, exists in allotropic modifications, an amorphous red variety, a crystalline form, and a grey crystalline form termed *metallic selenium*. This last modification conducts electricity well, and its conductivity is greatly increased by exposure to light, a property which has been applied in the optophone (q.v.), and in the telegraphic transmission of pictures. Selenium is also used in glass manufacture to produce a red coloration.

Selenium forms compounds which show a general resemblance to those of sulphur. Thus it unites with hydrogen to form hydrogen selenide (H_2Se), a colourless, poisonous gas of disagreeable odour, the analogue of hydrogen sulphide (H_2S). It burns in air with a blue flame, forming selenium dioxide (SeO_2), a white, crystalline compound chemically similar to sulphur dioxide (SO_2).

Seleu'cia, the name of several cities in Asia, founded by Seleucus Nicator. The most celebrated was Seleucia-on-the-Tigris, the eastern capital of the Seleucidæ, about 30 miles from Babylon. It was one of the richest commercial cities of ancient times, counting about 600,000 inhabitants, chiefly Greeks. Taken by the Parthians in 140 B.C., and sacked by Trajan in A.D. 116, it was soon deserted, and became as desolate as Babylon itself. The next in importance was Seleucia Pieria, founded in 300 B.C., and situated on the sea-coast at the foot of Mount Pieria, 12 miles west of Antioch, of which it was the seaport, and which it rivalled in splendour.

Seleu'cidæ, a dynasty of kings who succeeded to that portion of the empire of Alexander the Great which embraced the Asiatic provinces, and is generally known as Syria.—Seleucus I, surnamed *Nicator*, the founder of the line, was born about 358 B.C., and was a general of Alexander the Great, shortly after whose death (323 B.C.) he obtained the satrapy of Babylon. He gradually extended his possessions from the Euphrates to the Indus, assumed the title of king in 306, and afterwards acquired Syria and the whole of Asia Minor, but was assassinated in 280 B.C. He is said to have been the most upright of Alexander's successors, and was the founder of Antioch and other cities. He was succeeded by his son Antiochus I and by a number of monarchs of the name of Seleucus and Antiochus, the most distinguished being Antiochus the Great. (See *Antiochus*.) The power of the Seleucidæ began to decline as early as the reign of Seleucus II (246–226 B.C.), and they successively lost, through revolts and otherwise, Bactria, Parthia, Armenia, Judea, &c., and what subsequently remained was converted into a Roman province in 65 B.C.—Cf. E. R. Bevan, *The House of Seleucus*.

Self-denying Ordinance, an important measure, passed through Parliament on 3rd April, 1645, which provided that no member of Parliament should hold any civil or military office or command conferred by either or both of the Houses. This necessitated the resignation of Essex, Manchester, and others of the more timorous of the leaders, and eventually contributed to the success of the Parliament in the struggle with Charles I. Cromwell was himself retained in his command, under what was styled the 'New Model', an Act passed for the purpose of remodelling the army.

Seli'nus, one of the most important of the Greek colonies in Sicily, founded probably about 628 B.C. on the south-western coast of that island. Thucydides mentions its great power and wealth, and the rich treasures of its temples. It was conquered by the Carthaginians in 409, and in 249 destroyed by them. There are still important ruins of ancient Greek temples here, and valuable sculptures belonging to them have been preserved.

Seljuks, a Turkish family deriving its name from Seljuk, chief of a Turkish tribe of the Ghuzz group which gained possession of Bukhāra and embraced Islam. The most powerful of the various dynasties they founded in Mesopotamia, Persia, Syria, and Asia Minor during the eleventh and twelfth centuries were: (1) The Seljuks of Iran or Bagdad, and Isfahan. The founder, Togrul-Beg, grandson of Seljuk, completed the conquest of Persia about 1061. His notable successors were Alp-Arslan (1063–73), the conqueror of Egypt, Malik-Shah (1073–93), Mahomet-Shah (1105–18), and Sanjar (1118–58). This dynasty became extinct in 1194 with Togrul-Shah, who was vanquished by Tekesh, Sultan of Kharizm.—(2) The Seljuks of Kerman, who ruled the three provinces of Kerman. Their dynasty, founded by Kaderd, nephew of Togrul-Beg, ended in 1091.—(3) The Seljuks of Aleppo, in Syria, founded in 1079, and became extinct in 1114.—(4) The Seljuks of Damascus, founded in 1096 by Dekkah. His successors reigned till 1155.—(5) The Seljuks of Iconium, or of Asia Minor, founded by Suleiman-ben-Kutulmish, who was granted a territory in Asia Minor by the Sultan Kalek-Shah. During the reign of Alla-ed-Din II, one of the last princes of this dynasty, the Turk Osman distinguished himself. In 1300 the Seljuk Western Empire collapsed and the rise of the Osmanlis began.

Selkirk, or **Selcraig**, Alexander, British sailor, supposed prototype of 'Robinson Crusoe', born in Largo, Fifeshire, in 1676, died on board H.M.S. *Weymouth*, 1721. He took part in buccaneering expeditions in the South Seas, and in consequence of a quarrel with his captain he was put ashore, at his own request, on the main island of Juan Fernandez. There he lived alone for four years and four months, when he was taken off by Captain Woodes Rogers (q.v.) He returned home in 1712, and his adventures became known to the public. Defoe's *Robinson Crusoe* appeared in 1719, but Crusoe's experiences have but little in common with those of Selkirk, and his island was "near the Mouth of the Great River of Oroonoque". Selkirk, who is also the subject of a well-known poem by Cowper, afterwards rose to the rank of master's mate in the navy.

Selkirk, a royal and municipal burgh of Selkirkshire, Scotland, the county town, on Ettrick Water; the terminus of the North British Railway (branch line). It has monuments to Sir Walter Scott and Mungo Park. The staple industry is the manufacture of tweeds. In the vicinity is Philiphaugh, where the Covenanters under Leslie routed the forces of Charles I under Montrose. Pop. 8500.

Selkirk Mountains, a range of the Rocky Mountain system in the south-east of British Columbia, in a very wild and mountainous region rich in gold, and penetrated by the Canadian Pacific Railway at Rogers' Pass.

Selkirkshire (formerly known as *Ettrick Forest*), an inland county of South-Eastern Scotland, drained by the Tweed, and its affluents the Ettrick and the Yarrow, which unite to form the Ettrick Water at Carterhaugh. The county is hilly and possesses numerous small lochs, among which St. Mary's Loch is best known. Large numbers of sheep are reared, Cheviots being the prevailing breed. Among interesting historical scenes in the county are the field of Philiphaugh; Oakwood Tower, the reputed residence of Michael Scott, the wizard; and Newark Castle, the scene of Scott's *Lay of the Last Minstrel.* Woollens are largely manufactured, chiefly in Selkirk, the capital of the county, and in Galashiels. Area, 267 sq. miles; pop. (1921), 22,600.

Selle, Battle of the, one of the concluding phases of the European War. After the fall of Le Cateau (10th Oct., 1918) the British took up positions on the west bank of the Selle, and the battle began on the 17th, when communications had been repaired and strengthened. The Fourth Army (Anglo-American) and Debeney's French armies opened the attack; on the 19th the German armies retired across the Oise and Sambre Canal; on the 20th the British Third and First (part) Armies attacked on the line of the Selle, north of Le Cateau, and a terrific battle raged until the 25th. On the 26th Ludendorff resigned. Over 20,000 prisoners and nearly 500 guns were taken by the British armies during the various operations.

Selous, Frederick Courtney, British explorer, born 1851, killed in action 1917. He was born in London, but went to Matabeleland in 1872, exploring and shooting big game in Zambezia, and making many valuable contributions to ethnology and natural history. In 1892 he was awarded the Founder's Medal of the Royal Geographical Society. At the age of sixty-two he joined the Legion of Frontiersmen as subaltern, received the D.S.O. and a captaincy (Sept., 1916), and was killed at Beho-Beho on 4th Jan., 1917. In June, 1920, a national memorial to him was unveiled in London, and a Selous scholarship was founded at Rugby, his old school.—Cf. J. G. Millais, *Frederick Courtney Selous*; also *Geographical Journal*, xlix (1917), pp. 155, 221, 368.

Selwyn, George Augustus, British divine, born in 1809, died in 1878. Educated at Eton and at St. John's College, Cambridge, he was ordained deacon in 1833, and became curate at Windsor. In 1841 he was appointed the first bishop of New Zealand. In 1867 he accepted the bishopric of Lichfield, where he laboured indefatigably till his death.

Semantics, or **Semasiology**, that branch of philology which deals with the development of meanings of words, as distinguished from the study of sounds. Baldwin's *Dictionary of Philosophy and Psychology* defines Semantics as follows: " The doctrine of historical word-meanings; the systematic discussion of the history and development of changes in the meaning of words ".—Cf. L. Bloomfield, *An Introduction to the Study of Languages*.

Semecarpus, a genus of Asiatic and Australian trees, nat. ord. Anacardiaceæ. *S. Anacardium* is the marking nut, from which a marking ink is made.

Semele (sem′e-lē), in Greek mythology, a daughter of Cadmus by Harmonia, and beloved by Zeus. Jealous of her husband's mistresses, Hera persuaded Semele to entreat her lover to attend her with the same majesty as he approached Hera. As he had sworn to gratify her every wish, Zeus, though horrified at this request, came to her accompanied by lightnings and thunderbolts, when Semele was instantly consumed by fire. Dionysus (Bacchus) was her son by Zeus.

Sem′inoles, a tribe of North American Indians, an offshoot from the Choctaw Muskogees. They separated from the Confederation of the Creeks, and settled in Florida in 1750, under the name of Seminoles (i.e. fugitives or seceders). In 1842 all but a scanty remnant were transferred to Oklahoma, where they formed one of the Five Civilized Tribes. They number about 3400.

Semipalatinsk, a province of Asiatic Russia, has an area of 180,000 sq. miles, and a population of 874,000, chiefly Kirghiz, Cossacks, &c. It is one of the warmest regions of Russian Asia in summer, though the winter is extreme. The chief industry is cattle-raising.

Semipalatinsk, or **Semipolatinsk**, a town of Central Asia, on the Irtish. It has a considerable trade with the Kirghiz and with Tashkend, Khokand, Bukhāra, and Kashgar. Pop. 35,000.

Semir′amis, a queen of Assyria, whose history is enveloped in fable. As the story goes, she was a daughter of the fish-goddess Derceto of Ascalon, in Syria, by a Syrian youth. Attracted by her beauty, Onnes, Governor of Nineveh, married her. She accompanied him to the siege of Bactra, where by her advice she assisted the king's operations. She became endeared to Ninus, the founder of Nineveh (about 2182 B.C.), but Onnes refused to yield her, and being threatened by Ninus, hanged himself. Ninus resigned the crown to Semiramis, and had her proclaimed Queen of Assyria. She built Babylon, and rendered it the mightiest city in the world. Her whole history resembles an Oriental tale, and even her existence has been questioned. The legends about her probably absorbed some of those belonging to Astarte, or the Greek Aphroditē.

Semiretchinsk′, a province of Soviet West Turkestan close to the Chinese frontier; area, 145,000 sq. miles. Cattle are raised by the inhabitants, and agriculture is more or less developed in the southern district. Vernoye is the capital. Pop. 1,300,000.

Semites, a group of nations, some ancient, others modern, who have dwelt and still continue to dwell in Western Asia and Eastern Africa. They are said in *Gen.* x, 21–30 to be descended from Shem. In modern times the classification of the Semitic nations is based primarily upon linguistic characteristics, and is applied to the peoples who speak languages of the Semitic family. The Semites thus include: the North Arabians, South Arabians, Abyssinians, Babylonians, Assyrians, Aramæans, Phœnicians, Canaanites, and Hebrews. The question of the original home of the Semites has not yet been satisfactorily answered, although various theories have been put forward. Certain animal names being common to all the Semitic tongues, it was for a long time held that Babylonia was the home of the Semites, whence they spread over Arabia and Syria; but some scholars think they came from Mesopotamia, while more recent research favours Arabia. The most influential divinity among the early Semites was the goddess of fertility, and their earliest social organization was the matriarchate. Social justice was early developed among them, as is seen from the *Pentateuch* and the *Code of Hammurabi*. Semitic influences upon the non-Semitic world have been many. From Babylonia came the beginnings of astronomy and mathematics, from Phœnicia the alphabet; and the three great monotheistic religions of the world (Christianity, Mahommedanism, and Judaism) originated and were developed on Semitic soil. —BIBLIOGRAPHY: G. A. Barton, *A Sketch of Semitic Origins*; D. G. Brinton, *Races and People*; E. Renan, *Histoire générale des langues sémitiques*.

Semit′ic Languages, the languages belonging to the Semites or Semitic peoples, that is, those regarded as descendants of Shem. The Semitic languages form an important linguistic family, which is usually divided into a northern and a southern section. To the northern belong the ancient dialects of Assyria and Babylonia (recovered by means of the cuneiform inscriptions); the Hebrew, with the Samaritan and Moabitic; the Phœnician and Carthaginian; and lastly the Aramaic, which includes the Chaldee and the Syriac. The northern Semitic languages are now almost entirely extinct as spoken tongues, though Hebrew is to some extent still used in writing, and has been revived as a spoken language in Palestine. The most important of the south Semitic tongues, and the only one now in extensive use, is the Arabic, which as a spoken language may be divided into the four dialects of Arabia, Syria, Egypt, and Barbary. To this branch also belong the Himyaritic, formerly spoken in part of Arabia; the Ethiopic, or ancient ecclesiastical language of Abyssinia; and the Amharic and other modern dialects of the same country.—Cf. T. G. Tucker, *Introduction to the Natural History of Language.*

Semliki, a river of Central Africa, rising in Lake Edward, and flowing via the Belgian Congo into Lake Albert, forming one of the head-waters of the Nile; total length, 155 miles (100 miles in the Congo; the rest along the Congo-Uganda frontier). The Semliki Valley, broad, shallow, and afforested, forms the main trunk of the Western Rift Valley; it is traversed by the river, and the adjacent alluvial and diluvial plain is the haunt of buffalo, antelope, and elephant, while the forest is the habitat of the chimpanzee and baboon. Fish is plentiful in the river, but fishing is prohibited. The valley is partly a tse-tse fly belt, and is inhabited by the autochthonous pygmy people of Uganda: the slopes of the valley are peopled by the mountaineers, the Bakonjo. Along the river the annual rainfall is approximately 100 inches.

Semnopithe′cus, a genus of Old World monkeys, including the langurs, to which belong the Entellus monkey (*Semnopithēcus entellus*) or hanuman, the sacred monkey of India, and about a dozen allied species.

Sempach, a village of Switzerland, in the canton of Lucerne, on the Lake of Sempach (3½ miles long). It was the scene of a victory (1386) gained by the Swiss over the Austrians under Leopold. Pop. 1100.

Senate, originally the supreme legislative body of ancient Rome, first instituted, according to tradition, by Romulus. Tarquinius Priscus is said to have increased the number of members from 100 to 300, thus making 100 representatives for each of the Patrician *tribes*. Under the Republic the consuls, consular tribunes, and later the censors, had the power of choosing the senators; but they were restricted to those who had previously held magistracies, and as the magistrates were chosen by popular election the senate was ultimately a representative body. Curule magistrates and quæstors had a seat *ex officio* in the senate, and a right to speak, but not to vote. In the administration of affairs the senate was supreme, and during national crises could invest the consuls with absolute and dictatorial authority. A decree of the senate was called *senatus consultum*. After this body had remained for several centuries at 300, their number was raised by Sulla to 600, he having added 300 equites to the senate. Julius Cæsar made a further increase of 300, and at one time there were 1000, but Augustus lowered their number to 600. The majority of votes always decided a question. Under the Republic the tribunes of the people could veto every proposition before the senate. Under the Emperors the senate gradually lost its political consideration; finally it often accepted and passed the imperial decrees without deliberation. In modern times the term is applied to the upper or less numerous branch of a legislature in various countries, as in France, Italy, the United States, in Canada, South Africa, Australia, &c. Senates were set up in both the Parliaments of Ireland by the Act of 1920. It is also used to designate the governing body of certain universities.

Sen′eca, Lucius Annæus, known as 'the elder' or 'the rhetorician', to distinguish him from his more celebrated son, was born about 54 B.C., and died about A.D. 39. He attended lectures by the most famous Roman orators, though he never heard an oration of Cicero, his chief favourite. When a very old man he made a collection of *Controversiæ*, or imaginary legal cases. For our knowledge of about half of this book we are dependent upon an abridged edition made for the use of schools in the fourth or fifth century A.D. It is an interesting book, and is valuable on account of the prefaces, which give accounts of individual orators. Some of the anecdotes in this book were subsequently embedded in the miscellaneous collection known as *Gesta Romanorum* (q.v.). The other extant work of Seneca the elder is the *Suasoriæ*, or exercises in deliberative oratory. In it questions of this kind are discussed: "Should Cicero apologize to Marcus Antonius?" "Should Alexander embark on the ocean?" Seneca's work has not much intrinsic value, but it is of the greatest importance to students of Roman educational methods.

Seneca, Lucius Annæus, known as 'the younger' or 'the philosopher', to distinguish him from his less celebrated father, was born about 3 B.C., and died in A.D. 65. He became an ardent Stoic (if that is not a contradiction in terms), and practised successfully at the Bar. Caligula was jealous of him, and in the reign of Claudius he was implicated in some of the scandals concerning Julia, the sister of Caligula, and banished to Corsica for eight years. On his return in A.D. 48 he was made tutor to Nero, and when Nero became emperor, Seneca and the prætorian prefect Burrus practically acted as regents. Seneca proved himself a wise and enlightened ruler, but in his personal relations with the emperor he was not made of sufficiently stern stuff to check his imperial master's tendencies to degeneracy. His influence over the emperor's public policy was great at first, but gradually dwindled to nothing. There is no doubt that he failed to discourage Nero from murdering his mother, an act which could hardly be called a crime, as she was such an odious woman, but which was a ghastly blunder. Nero became jealous of his great influence and wealth, and there was a complete breach between them. Seneca offered to retire into private life and to give his whole fortune, except a pittance to live upon, to the emperor, but his offer was refused, and he was compelled to commit suicide. This he did by being suffocated in a vapour-stove, after having his veins opened and drinking hemlock.

Seneca is the principal writer of his age, because he is so typical of it. His influence, which was considerable, was always for the bad. He is the chief exponent of insincerity and epigram. His *Quæstiones Naturales* is a popular book on physics of no scientific and little other merit. His *Skit on the Death of Claudius* (usually but erroneously called the *Pumpkinification*, there being no mention of the transformation of Claudius into one of these vegetables) is a tasteless and witless production. It has been compared with Petronius, but the *Satiricon* is as full of humour as a novel of Fielding, and the *Apocolocyntosis* as devoid of it as a German comic paper. Seneca's other prose works are mostly of a moralizing nature—twelve *Dialogues*, three books *On Clemency*, seven *On Benefits*, and twenty books of *Letters to Lucilius*. It is always easier to preach than to practise, but Seneca's moralizing is so extremely unctuous and his life was so unheroic that it is impossible to make one square with the other in the least degree.

Ten tragedies have been attributed to Seneca. Nine of them are on standard tragic themes—*Hercules Furens*, *Thyestes*, *Phædra*, *Œdipus*, *Troades*, *Medea*, *Agamemnon*, *Hercules Œtæus*, and the incomplete *Phœnissæ* (*Thebais*). The other one, *Octavia*, deals with the married life of Nero, a fit subject for a tragedy. It is believed not to be by Seneca, and some have attributed it to Curiatius Maternus. It is probable that these tragedies were mere closet-dramas; they were 'reckoned much too thoughtful for the stage'. They are full of rant, bombast, and bloodshed. Their iambic lines are monotonous, and their lyrics indistinguishable as such save by metre. These tragedies exercised a malign influence upon early English tragedy, as inexperienced criticism rated them as equal to the work of Æschylus, Sophocles, and Euripides.

Senecio, a very large and cosmopolitan genus of Compositæ, comprising over 1200 species, and including plants of the most various habits (climbers, succulents, heath-like forms, &c.). The British species are weedy plants, *S. vulgaris* (groundsel) and *S. Jacobœa* (ragwort) being the best known. The favourite greenhouse plant known as Cineraria is included in the genus by many botanists.

Sen′ega, or **Sen′eka** (*Polygăla Senĕga*), a plant belonging to the nat. ord. Polygalaceæ, common in the United States. Its root, sometimes called snake-root, is used as an expectorant and diuretic.

Sen′egal, a river of West Africa, which rises in the Futa Jallon Hills in two branches joining near Bafoulabé (i.e. 'meeting of the waters'), and after a course of some 1000 miles falls into the Atlantic in lat. 16° N., near St. Louis (q.v.). The Falémé is its chief tributary. It is navigable during the rainy season as far as Kayes, from which a French railway proceeds up the stream and then across to Bammako on the Upper Niger.

Senegal, a colony of French West Africa; area, 74,112 sq. miles; pop. 1,225,540 (1,221,200 being of African race). Ground-nuts, millet, maize, and some rice are cultivated by the natives, the former comprising the great bulk of the exports. Other products are castor-beans, coco-nuts, gum (from Mauritania), and some rubber. There is a salt industry, and the natives manufacture pottery, bricks, jewellery, and woven goods. Towns include St. Louis (capital; pop. 23,500, 307 being French), Dakar (naval station and seat of Governor-General; pop. 25,500, 2800 being French), Rufisque (pop. 11,500), and Goree (pop. 1500). The colony is governed by a Lieutenant-Governor and a Colonial Council (40 members, 20 elected by native chiefs, &c., and 20 by French citizens), and there are eleven 'circles' each under an administrator. One Deputy is sent to the Chamber at Paris. There are two railways: (1) Dakar-St. Louis, via Thiés (165 miles); and (2) Thiés-Kayes (Upper-Senegal-Niger), 682 miles.

Seneschal, a term originally applied in the Middle Ages to the major-domo or steward whose duty it was to superintend the affairs of his lord's household. Gradually the seneschalship rose to be an office of dignity, and was held by military commanders. In France the *sénéchaussée* was the jurisdiction of a *sénéchal,* as in the course of time that officer came to be invested with judicial functions. The royal seneschal was called *grand sénéchal,* in contradistinction to the seneschals of the feudal princes. The Counts of Anjou were by hereditary right the grand seneschals of France.

Senior, Nassau William, English economist, born 1790, died 1864. In 1825 he was appointed to fill the new chair of political economy at Oxford. His writings include: *An Outline of the Science of Political Economy, Political Economy,* and *Historical and Philosophical Essays.*

Senlis (saṇ-lēs), a town of France, in the department of Oise. It has old walls, flanked by watch-towers; ruins of an ancient castle, the residence of French kings from Clovis to Henri IV; and a small cathedral. It was the headquarters of Marshal Foch in Nov., 1918. Pop. 7000.

Senna, a substance used in medicine as a powerful cathartic, consisting of the leaflets of several species of Cassia. Alexandrian senna is derived from *Cassia acutifolia* and *C. obovāta.* It is grown in Nubia and Upper Egypt. Other commercial varieties are Indian senna, Mecca senna, and Tripoli senna. It is frequently adulterated with the leaves of other plants.

Sennaar′, or **Sennar′,** an east-central province of the Anglo-Egyptian Sudan, on the Abyssinian frontier. It is a vast plain covered with alluvium, and exceptionally rich agriculturally. The principal towns, all on the banks of the Blue Nile, include Sennaar (the chief town), and Wad Medani, which are connected by rail with Khartum and Al-Obeïd. Area, about 39,000 sq. miles; pop. 150,000.

Sennach′erib, King of Assyria, son of Sargon II. He succeeded his father in 705 B.C., suppressed the revolt of Babylonia, and undertook campaigns against Cilicia, Phœnicia, and Palestine. The cities of Judah fell into his hands, and King Hezekiah was shut up in Jerusalem. The siege was raised in consequence of a miraculous visitation, and Sennacherib returned to Nineveh. From Herodotus we learn an Egyptian tradition regarding the destruction of Sennacherib's host, but no mention of it is found in the monuments of Sennacherib. The greatest architectural work of Sennacherib was the palace of Kouyunjik, which covered fully 8 acres. Of the death of Sennacherib nothing is known beyond the brief Scripture statement of *2 Kings,* xix, 37, and *Is.* xxxvii, 38, from which it appears that he was murdered by his own sons, Adrammelech and Sharezer (681 B.C.).

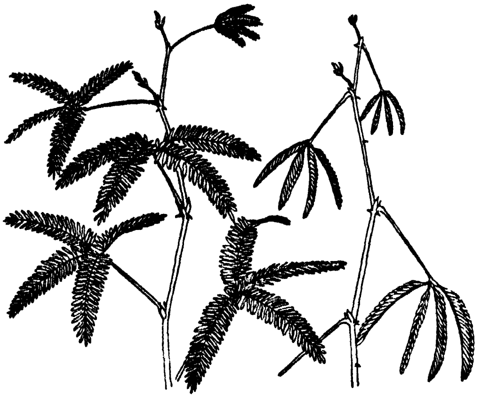
Sens, a city of North-Central France, in the department of Yonne, on the Yonne. It has a cathedral and some ancient buildings. Steel goods and hardware are among the manufactures. There are also flour-mills and chemical-works. Pop. 15,200.

Sensation, the name applied to indicate the consciousness of an impression made on sensory nerve fibres (see *Nervous System*). Such an impression on an organ of sense might reach a lower nerve-centre, and by reflex action induce a muscular movement, while the centres devoted to consciousness being asleep or preoccupied remained unaffected. To this kind of impression the term sensation is not applicable. The organs by means of which particular kinds of impressions are primarily received, and thence transmitted to the brain, are called the organs of the senses. Such are the highly specialized mechanisms of the eye and ear, as well as the sensory nerve endings in the nose, tongue, and skin, instrumental in providing us with the various discriminated sensations of smell, taste, and touch. Physiologists long ago abandoned the popular view that man has only five special senses. The sense of touch has been shown to consist of at least three distinct senses, those of pressure, heat, and cold; and the sense of pain is equally entitled to recognition, on physiological and anatomical grounds, as a special and characteristic sense. It is now customary to classify the senses into two great groups. (1) Those which we refer to the exterior of the body and thence to the outside world. (2) Those by which we acquire knowledge of bodily states in respect of position and movement of the whole body or of parts, hunger, thirst, fatigue, &c. Of the sensations which are most readily perceived by animals that of *resistance* or *touch* is perhaps the most widely diffused. Next to resistance sensibility to *heat* is the best defined and most frequently displayed sensation. The sense or consciousness of *light* or luminosity succeeds that of temperature; *taste* comes next in order; then *hearing;* whilst *smell* is probably one of the least diffused of sensations. See *Eye; Ear; Nose; Smell; Touch.*

Sensationalism, in philosophy, the theory or doctrine that all our ideas are solely derived through our senses or sensations. The source of our knowledge is sensuous perception, inner or outer, and by combining and elaborating these perceptions we gather experience. Sensationalism thus maintains that experience is the *sole,* or at least the principal, source of knowledge. Sensationalism has been expressed in the dictum: *Nihil est in intellectu, quod non fuerit in sensu.* The Sophists, Hume, Condillac, and Locke, as well as Mill, Spencer, and James, were sensationalists. Sensationalism is opposed to intellectualism. See *Empiricism.*

Sensitive Flames, gas flames which are easily disturbed by sounds made in their neighbourhood. The effect was first noted by Leconte in America in 1857; since then, various forms of burners which give sensitive flames have been described. A simple burner can be made from a piece of glass tubing with a narrow orifice; the tube when connected to the gas supply gives a very long thin flame, which is adjusted until on the point of flaring. On rattling a bunch of keys, chinking a handful of coins, whistling or making a hissing sound, the flame instantly ducks and roars, returning to its normal form when the disturbing sound ceases. The range of sounds to which the flame responds is limited, and is influenced by the gas pressure and the width of the nozzle. The seat of sensitiveness is the nozzle of the burner; the flame merely serves to indicate the disturbance of the current of gas. Lord Rayleigh has employed sensitive flames in measuring very short sound waves.

Sensitive Plant (*Mimōsa pudīca*; nat. ord. Leguminosæ), a plant celebrated for its apparent sensibility. It is a native of tropical America, but is often seen in British greenhouses. The leaves are compound, consisting of four leaves, themselves pinnated, uniting upon a common footstalk. At the approach of night the leaflets all fold together; and the common footstalk bends towards the stem; at sunrise the leaves gradually unfold, and recover their usual state. So far, this is evidently the effect of light; similar, but much more rapid movements, however, take place if the plant is touched at all roughly. The same property belongs to other species of Mimosa, to other leguminous genera, and to species of Oxalis.



Sensitive leaves of *Mimōsa pudīca*

In natural position on left. Position when touched on right.

Sentinel Crab (*Podophthalmus vigil*), a species of crab so named from its active watchful habits, and from the very elongated footstalks upon which the eyes are set. It inhabits the shores and islands of the Indian Ocean.

Senussi, the eponym of the Senussiyeh, a Mahommedan fraternity of North Africa. Sayyid (or Sidi = Lord) Muḥammad ben Ali es Senussi (1796–1859), one of the Ashraf, tracing descent from Fatima, daughter of Mahomet, founded the first *Zāwiya* (lodge, college) in 1835. He was succeeded by his son Sayyid Al-Mahdi (1844–1902), under whom the Senussiyeh exerted authority over practically the whole of the Eastern Sahara and Central Sudan, and their influence was great throughout North Africa. Ahmed esh Sherif, Al-Mahdi's nephew, became Sheikh in 1902, but fled to Turkey in 1916, when Sayyid Muḥammad Al-Idris, Al-Mahdi's son, became Grand Senussi. The Senussiyeh form a dervish order belonging ostensibly to the Malekite sect (one of the four orthodox sects of Islam), and their organization in fraternities and orders has made them of considerable value as a political weapon. Their theology is Sufic in its form, and they are great reformers, nominally very orthodox; in short, they are the catharists of Islam. The Zāwiya of Al-Jof (the hollow), is the Senussiyeh Holy of Holies and the chief place at Kufara.

The Kufara Oases.—The group of five oases lies in the heart of the Libyan Desert, and is about 200 miles south of Jalo, the journey by camel occupying eleven to twelve days. Rohlfs visited it in 1879, and since then only Mrs. Rosita Forbes (author of *The Secret of the Sahara: Kufara*), who was disguised as a Muslim, has been permitted to go there (1923). Buseima, a salt lake 6 miles long with a date-palm fringe ½ mile in depth, is the central oasis, and around it, on one-hundred-mile radii, lie: (1) Kufara, the principal group of oases, generally but erroneously called Kebabo. (2) Taiserbo, the second in importance (2130 feet altitude), whose palm grove measures 60 by 15 miles; (3) Zighen or Sirhen; and (4) Erbehna. The name 'Kufara' is identical with Ar. *Kufara*, unbelievers, and was applied to the original heathen Tebu tribes of the oases, now practically extinct.

On the outbreak of the European War the Sheikh es Senussiyeh was the only independent chief in North-East Africa, and his leadership of a highly organized uniformed and disciplined force, which was maintained on a permanent war-footing (the *Muhafizia*), and which had already opposed the French Sudanese conquests, and battled with the Italians in Cyrenaica, caused General Sir John Maxwell much anxiety for the security of Egypt. In Nov., 1915, as a result of Turco-German pressure, Sayyid Ahmed led a powerful force of *Muhafizia* across the Libyan Desert Plateau, and certain Egyptian forces were withdrawn. Fighting began on 11th and 13th Dec., and culminated in the British victories of Halazin (23rd Jan., 1916) and Agagia

(26th Feb.), and the occupation of Sollum *(14th March). Sayyid Ahmed advanced towards the* south, but was pushed back, and a sympathetic movement of 'Ali Dinar, Sultan of Darfur, was also crushed by the Sirdar's (General Sir Reginald Wingate's) troops operating from Khartum as base and Al-Obeïd as *rail-head.* A battle was fought at Beringa (22nd May, 1916), near the Darfur capital (Al-Fasher), when the Dervishes were defeated and suffered a 50-per-cent loss in personnel. 'Ali Dinar fled and was pursued by a mobile column (Oct., 1916), being killed in action on 6th Nov. Darfur was annexed to the Sudan as a province, wireless stations (three) being erected, and the Sudanese telegraph system extended to Al-Fasher. Sayyid Muḥammad Al-Idris, the new Grand Senussi, recognized Italian sovereignty, and his spiritual authority as head of the order (which had never been challenged by any of the Allies) was duly admitted. He was made emir, and subsequently (1919) did homage to the Italian king at Rome.

Separated Milk, milk from which most of the fat has been extracted by means of the cream separator. It contains the whole of the protein, and is used, enriched by the addition of oil or patent preparations, for the feeding of calves, or, commercially, for the manufacture of casein or milk-sugar and in baking. The average composition of separated milk is:

	Per Cent.
Water	90·58
Fat	0·12
Lactose	4·95
Casein	3·15
Albumin	0·42
Ash	0·78

As milk fat is lighter than water its removal raises the specific gravity, which is about 1·036 for separated, as compared with 1·032 for whole milk. The ratio of non-fatty solids to water, in separated milk, is practically the same as that found in whole milk; the proteins are not appreciably diminished by the removal of small amounts in the separator slime. The British standard for separated milk is 8·70 per cent 'solids non-fat'.

Separation Allowances, now known as marriage allowances, are payments of money by the State to the wives and children of sailors, soldiers, and airmen on active service. The rates are the same for all branches of the forces, and vary with the cost of living. For the year ending March, 1923, the scale of weekly payments is as follows: for wife alone, 7*s.*; for wife and one child, 14*s.*; for wife and two children, 19*s.*; for each other child up to and including the sixth, 2*s.*; for wife and seven children, 28*s.* 6*d.*; and for each remaining child, 1*s.* 6*d.* If no allowance is paid for the wife or if the wife is dead, 7*s.* is deducted from each step in the foregoing scale. Thus the weekly allowance paid for one child is 7*s.*; for two children, 12*s.*; for three children, 14*s.*; and so on. For the year ending March, 1924, these allowances will be reduced (through the fall in the cost of living) approximately as follows: by 6*d.* when there is only one child; by 1*s.* when there are two to four children; by 1*s.* 6*d.* when there are five; by 2*s.* when there are six or seven; and by 6*d.* for each additional child. 7*s.* is the minimum wife allowance, however much the cost of living may fall. No allowance is paid before the soldier or airman has attained twenty-six years of age, and in the case of children (which term includes stepchildren and legitimated children) it ceases at age fourteen. It is paid to Territorials and Special Reservists during their annual training and instructional courses, and in all cases it continues during periods of furlough and hospital treatment.

Se'pia, a genus of Cephalopoda or cuttle fishes, included in the family Sepiidæ. These cephalopods, of which the *Sepia officinalis,* or common sepia, is a typical example, belong to the dibranchiate section of their class, and to the group of decapoda. The family Sepiidæ possesses an internal calcareous shell, the so-called *sepiostaire* or 'cuttle bone', which is often cast up upon some coasts, and was formerly in repute as an antacid in medicine, and as the source of the 'pounce' once used for spreading over eroded ink-marks to form a smooth surface for the corrected writing. There are four rows of pedunculated suckers on the arms of the genus Sepia. Lateral fins exist. The two tentacles, or arms, which are longer than the remaining eight, possess suckers at their expanded extremities only. The eggs of the sepia resemble bunches of grapes in form, and hence are sometimes called 'sea-grapes'. The common sepia occurs on the

Sepia

southern English coasts, but more especially in the Mediterranean Sea. It is chiefly sought after on account of the inky matter which it affords. This secretion, which is insoluble in water, is agitated in water to wash it, and then allowed slowly to subside, after which the water is poured off, and the black sediment is formed into cakes or sticks. When prepared with caustic lye it forms a beautiful brown colour, with a fine grain, and has given name to a species of monochrome drawing.

Se'poys, a corruption of the Hindustani word *Sipāhi* (from the Persian), used to describe soldiers in the native Indian army. It is used in two senses, generally as above, but more narrowly to mean 'private'. In this last connection it is applied to infantry soldiers only, native cavalry troopers being known as *sowārs.* Sepoy is also used in the Indian police and on ships employing Lascars. It is not used in Gurkha or other rifle battalions, where the men are called *riflemen.*

A sepoy enlists nominally for long service, but he has the right, under certain conditions, to take his discharge after three years' service. After eighteen years' service he becomes eligible for a small pension, and it is unusual for a man who has not risen beyond the rank of sepoy to be retained in the service after reaching a pensionable age. Non-commissioned officers are pensioned after twenty-one years' service.

The great majority of sepoys are of the small-landowner class, holding their land direct from Government, and the custom in such families usually is for one or two of the sons to serve in the army, while the remainder look after the land. The average sepoy is generally uneducated when he enlists, and in many cases cannot read or write. However, the modern craze for educating everybody has not overlooked him, and he is being caused to assimilate much information which may, or may not, make him a better soldier. See *Army* (section, *The Army in India*); *Brahmans*; *Dogra*; *Gurkha*; *Sikh*; *Pathan*; *Rajput.*

Septa'ria, nodules found in rocks, and usually composed of clay ironstone, or limestone mixed with clay; they are characterized by cracks (almost always filled up with some mineral) which are due to shrinkage and which give them a partitioned appearance when cut and polished. Great numbers are found in the London Clay of the Isle of Sheppey, and in the shales of coal-fields.

September (from the Lat. *septem*, seven), the ninth month of our year, but the seventh of the old Roman year, which began in March. It has always contained thirty days.

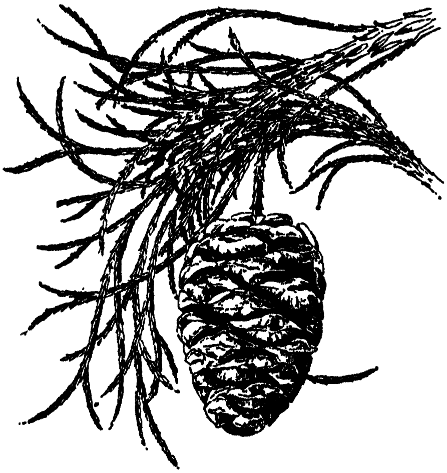
Septicæmia is a condition in which organisms (bacteria) are present and living in the blood-stream. Pyæmia is a sequel to this condition, in which these organisms produce abscesses in different parts of the body. In septicæmia a site of infection can usually be found, and from this site the infection is spread by the circulation. There is marked wasting of the tissues of the body, a daily rise and fall of temperature, frequent rigors, rapid pulse, coated tongue, headache, and either constipation or diarrhœa. The occurrence of abscesses (pyæmia) gives rise to symptoms in the part affected. Septicæmia may follow any septic condition or disease, and is evidence that, for the time being, the defensive arrangements of the body have broken down. Recovery takes place, however, in many cases when the body resistance is increased and later overcomes the infection.

Sep'tuagint, or the LXX, the Version of the Seventy, the Alexandrine Version, the most ancient Greek version of the Old Testament. It is so called either because it was approved and sanctioned by the sanhedrin, or supreme council of the Jewish nation, which consisted of about seventy members, or because, according to tradition, about seventy men were employed on the translation. The language is the Hellenistic Greek of Alexandria, based upon the Attic dialect. The translation is reported by Josephus to have been made in the reign and by the order of Ptolemy Philadelphus, King of Egypt, about 270 or 280 years before the birth of Christ. It is believed, however, by modern critics that the *Septuagint* version of the several books is the work not only of different hands, but of separate times. It is probable that at first only the *Pentateuch* was translated, and the remaining books gradually. The *Septuagint* was in use up to the time of our Saviour, and is that out of which most of the citations in the New Testament from the Old are taken. It is an invaluable help to the right understanding of the Hebrew Scriptures. The principal extant MSS. known are the Codex Alexandrinus in the British Museum, the Codex Vaticanus in Rome, and the Codex Sinaïticus (imperfect) at Petrograd. The principal printed editions are the Complutensian (1514–7), the Aldine (Venice, 1518), the Roman or Sixtine (1587), and the new Cambridge (1887–95).

Sequestration, in law, the act of separating a thing in controversy from the possession of both parties, till the right is determined by course of law. It is either voluntary or necessary: voluntary when it is done by consent of the parties, and necessary when it takes place by order of the official authority. See *Bankruptcy.*

Sequo'ia, a genus of conifers, otherwise called *Wellingtonia* or *Washingtonia*, consisting of two species only—*S. sempervirens*, which furnishes the valuable timber *redwood*, and *S. gigantea*, the Wellingtonia of British gardens and shrubberies.

also called the 'big tree' and 'mammoth tree'. They are both natives of Western America. They grow to a gigantic size, specimens of 300 feet in height, and 30 feet in girth near the ground, being not uncommon. The Mammoth Grove in California contains about ninety large trees, and the Mariposa Grove about four hundred. These trees must be very old; the age of one felled some years ago was found from its rings to be 1335 years. The sequoia was a very important tree in early geological times, and was widely diffused over both hemispheres.



Sequoia, Shoots and Cone

Seraing (sė-raṇ), a town of Belgium, in the province of Liége, 5 miles south-west of Liége, on the Meuse. Cockerill's extensive iron-, steel-, and machine-works (including also coal-mines) are established there, and the town is the centre of a populous industrial area. Pop. 41,000.

Serajevo, or **Sarajevo**, a city of Yugo-Slavia, the capital of Bosnia, on the Miljačka; served by narrow-gauge, single-line railway from Brod, on the Save Valley line (165 miles). There is a strategic railway to Uvac, and a municipal electric railway. There are varied industries. Serajevo owes its historical prominence to the assassination there of the Archduke Ferdinand (28th June, 1914), an event which precipitated the European War (q.v.). Pop. 51,000.

Sera'pis, or **Sara'pis**, an Egyptian deity whose worship was introduced into Egypt in the reign of Ptolemy I. Plutarch and Tacitus relate that Ptolemy having seen in a dream the image of a god, which he was ordered to remove from the place in which it stood, sent to Sinope, and brought thence a colossal statue, which he set up in Alexandria. It was declared to represent the god Serapis, and appears to have been originally a statue of Pluto or Jupiter. The name Serapis is composed of the names Osiris and Apis. A magnificent temple was built at Alexandria for the reception of the statue of Serapis, and this temple—the Serapeum—was the last hold of the pagans in that city after the introduction of Christianity. The Egyptians themselves never acknowledged Serapis in their pantheon, but he was the principal deity in the Greek and Roman towns of Egypt. Forty-two temples are said to have been erected to him in Egypt under the Ptolemies and Romans; his worship extended also to Asia Minor, and in A.D. 146 it was introduced to Rome by Antoninus Pius. The image of Serapis perished with his temple at Alexandria, which was destroyed in 389 by the order of Theodosius.

Serbia, a district of Yugo-Slavia (q.v.), the dominating partner in the Serb-Croat-Slovene state. *Physical.*—There are three physical divisions: (1) the eastern mountain region; (2) the southern region, of rolling downs, draining to the Ægean; and (3) the north-western area, a region of forests and wooded hills, including also the plain of Kosovo, well-watered, fertile, and populous. The Danube, Morava, and Save are the chief navigable rivers; the Vardar and the White and Black Drin are others. Two large lakes, Okhrida and Prespa, are famous for their fish. Climatically Serbia is temperate and healthy, but malaria and typhoid are prevalent. When water is obtained from wells in Serbia, it is generally contaminated and causes typhoid. Typhus, spread by body vermin, is endemic, and has been caused by the breakdown in the sanitary services of the state through a lengthy period of warfare, assisted also by privation and want. *Production.*—Over 91 per cent of the people are owners of land; peasant-proprietorship has obtained since the expropriation of Turkish landowners in 1833, and Serbia is pre-eminently an agricultural land. Cereals come from the plain of Machva and from the Morava valley, where also sugar-beet, hemp, tobacco, the poppy, and the mulberry are largely grown; vineyards and grazing-lands exist on the hills, and orchards in the south-west produce annually a veritable plethora of plums, used largely in the manufacture of *slivnitsa*, the *vin du pays* of Serbia. Viticulture, vegetable-culture, and stock-raising are progressive. Forests once occupied a large area, but have been encroached upon by arable land, and devastated by nearly a century of constant warfare. About one-third of the country is afforested, the principal varieties of tree being beech, oak (60 per cent of the total), and conifers. Minerals are confined to the northern half of the country, and include lead, zinc, copper, arsenic, antimony, mercury, coal, lignite, iron, arsenical pyrites, chrome, silver, sulphur, magnesite, manganese, alluvial gold (from the Pek and Tsrna Reka valleys), and beautiful marble is quarried in the Podrinye district. Mineral-springs include several with radio-active properties. Lack of transport has hindered mineral development.

Area, &c.—The area of Serbia is 42,098 sq. miles, and the pop. 4,960,000. Towns include: Belgrade (the capital, pop. 120,000), Skoplye (47,400), Nish (25,000), Kraguyevats (18,400), Leskovats (15,000), Shabats (11,500), and Pirot (11,000).

History.—Serbia was anciently inhabited by Thracian tribes; subsequently it formed part of the Roman province of Mœsia. It was afterwards occupied in succession by Huns, Ostrogoths, Lombards, Avares, and other tribes. The Serbians entered it about A.D. 610, and were converted to Christianity in the eighth century. They acknowledged the supremacy of the Byzantine emperors, but subsequently made themselves independent, and under Stephan Dushan (1331–55) the Kingdom of Serbia included all Macedonia, Albania, Thessaly, Northern Greece, and Bulgaria. About 1374 a new dynasty ascended the throne in the person of Lazar I, who was captured by the Turks at the battle of Kosovo (in Albania) in 1389, and put to death. Serbia now became tributary to Turkey, and its independence was finally extinguished in 1459; the native aristocracy, so far as they escaped extermination, found refuge in Montenegro. By the Peace of Passarowitz in 1718 Austria received the greater part of Serbia, with the capital, Belgrade. But by the Peace of Belgrade in 1739 this territory was transferred to Turkey. The barbarity of the Turks led to several insurrections. In 1804 George Petrovitsh (Kara George) placed himself at the head of the malcontents, and, aided by Russia, eight years of fighting culminated in the unsatisfactory Peace of Bucharest, 28th May, 1812. The war was renewed in 1813, and the Turks prevailed. In 1815 all Serbia rose in arms under Milosh Obrenovitsh, and after a successful war obtained complete self-government, Milosh being elected hereditary prince. Milosh was compelled to abdicate in 1839, and was nominally succeeded by his son Milan, who died immediately, leaving the throne vacant to his brother Michael. In 1842 this prince was compelled to follow the example of his father and quit the country. Alexander Karageorgevitsh, son of Kara George, was elected in his place; but in Dec., 1858, he also was forced to abdicate. Milosh was then recalled, but survived his restoration little more than a year. His son Michael succeeded him (1860), but was assassinated by the partisans of Prince Alexander on 10th July, 1868. The princely dignity was then conferred on Milan Obrenovish, grand-nephew of Milosh. After the fall of Plevna (Russo-Turkish War, 1877–8) Serbia took up arms against Turkey, and by the Treaty of Berlin (13th July, 1878) obtained an accession of territory and the full recognition of its independence, being subsequently erected into a kingdom (1882). In 1885 a short war took place between Serbia and Bulgaria, resulting in favour of the latter. In 1889 Milan abdicated in favour of his son, Alexander I. He and his queen were assassinated in 1903, and Peter Karageorgevitsh, grandson of Kara George, succeeded. A pro-Russian policy was inaugurated during the reign of King Peter, and when Austria annexed Bosnia and Herzegovina in 1908, the tension between Serbia and the Dual Monarchy gradually increased. In 1912 Serbia entered into an alliance with Bulgaria, Greece, and Montenegro, thus helping to precipitate the Balkan War. By the terms of the Treaty of Bucharest (1913) King Peter almost doubled his territory, at the expense not only of Turkey, but also of Bulgaria. The hostility between Serbia and Austria-Hungary now gradually increased, and in 1914 Austria declared war on Serbia, an event which led to the European War (q.v.), and foreshadowed the aggrandizement of Serbia and her hegemony in a kingdom of Serbs, Croats, and Slovenes. In 1914 King Peter handed over the power of government to his son Alexander, who was Regent from 24th June, 1914, till 16th Aug., 1921, when, after the death of his father, he ascended the throne. See *Yugo-Slavia.*—BIBLIOGRAPHY: H. W. V. Temperley, *History of Serbia*; *Peace Handbooks, No. 20* (H.M. Stationery Office); L. F. Church, *The Story of Serbia*; L. F. Waring, *Serbia.*

Language and Literature.—The Serbian language, spoken by the inhabitants of the new kingdom of Yugo-Slavia, belongs to the Slavonic languages, of which it represents an independent group, differing now considerably from the old Slavonic. The Catholic Serbs use the Latin alphabet, while the Greek Orthodox use the Cyrillian script, invented by Cyril, the Apostle of the Slovenes. He translated the service books into the old Slavonic, and they have remained to this day the authorized books of the Church. With slight dialectical modifications, due to Serbian scribes, these constitute the whole of the ancient literature down to the final Turkish conquest in the middle of the sixteenth century. The only important monument is the Code of Laws of Tsar Stephan Dushan (1336–56). To this period belong many apocryphal books, all of a religious character, and some of the mediæval romances. Dalmatian writers under the influences of Italy and the West flourished from the sixteenth to the eighteenth century, especially in Ragusa. The most important is Ivan Gundulich (1588–1638); others are: Drjich (died 1510), Cubranovich (died 1550), Pater Hektorovich (about 1572), and Junius Palmotich (1606–57). The real beginnings of Serbian literature date, however, from the Austrian conquest of the Serbian-speaking peoples, Vienna and Budapest becoming centres of literary activity, and later, in the nineteenth century, Agram (Zagreb) the capital of Croatia. A. K. Mioshich, Papal legate, was the first to collect popular songs and ballads (*Pesmaritza*, 1756). Real Serbian literary language based upon that of the people, and not upon the Serbo-Slovenian—the Church language—starts with Demeter Obradovich Dositey (1739–1811); but the actual father of modern Serbian language and literature was Vuk Stefanovich Karadjich (1787–1864), the collector of the unrivalled popular literature of Serbia. He simplified the orthography, and published the first Serbian dictionary. His collection of songs has been translated into many languages. Among modern writers are: Kachich (1836), Peter Petrovich Nyegosh (1813–51), Yovan Yovanovich (nicknamed *Zmay*, i.e. ‘the Dragon’) (1833–1904), Kostich, Lazar Lazarevich, and Mtavuli. Besides the great works on Slavonic language and literature in general, including Serbian, by Schafarik, Miklosich, and Jagich, for Serbian literature in particular see Stoyan Novakovich (1871), Popovich (1912), Gavrolovich (1913), Bogdanovich (1914), and the older work of Pypin and Spassovich (1879). Budmani's *The Great Dictionary* is the best Serbian dictionary.

Serenade and Serenata. The serenade, whether vocal or instrumental, is always concerned with the music of love. Where the voice is used it is presumed that the lover himself is singing; his song is simple, that it may impress with its sincerity; and it is generally quiet, to match the evening hour. An instrumental serenade is played by a band the size of which may vary from quite modest dimensions to the full orchestra used by Brahms in his Serenade in D, Op. 11.

The serenata, also, may be vocal or instrumental. In the first instance a work in the form of a pastoral cantata is implied. An outstanding example of the vocal serenata is Handel's *Acis and Galatea*. The instrumental serenata was a favourite during the eighteenth century, and usually consisted of a large number of short movements, after the manner of a suite, but less formally constructed. The minuet was a favourite number for inclusion in the serenata, and the whole composition, being generally written for comparatively small bodies of players, had something of the quality of chamber-music, and was mostly intended for purely private performance.

Seres, or Siris (ancient Siræ), a town of Greece, the centre of the Macedonian cotton industry, and the see of a Greek Orthodox archbishop. Siris, Siræ, or Serrhæ, according to Herodotus, was the place where Xerxes left a party when retreating to the Hellespont; in the fourteenth century it was a flourishing city, and was seized by Stephan Dushan as his capital. Sultan Murad II took it from the Serbians between 1421 and 1451, and it did not become free from Turkish rule until the Treaty of London (1913). Pop. 19,000.

Sereth (se-ret′), a river of Roumania. It rises in the Carpathians (Bukowina), flows through Roumania, and joins the Danube 5 miles above Galatz after a course of 300 miles. Among tributaries are the Moldova (joining at Roman), Bistriţa (at Bacău), Trotuş (at Adjud), Buzău (at Barlad), and the Suczawa (in the Bukowina). The Sereth Valley forms a line of communication parallel to the Carpathians, and a railway runs up the right bank of the river from Focşani. Timber is floated down-stream to Galatz; the Bistriţa is also used for this purpose. The Sereth Valley is an important cereal-raising and viticultural region, and was the scene of heavy engagements between the Roumanians and the Germans during the European War.

On the spelling system of the Royal Geographical Society the name is properly Siret, but the Austro-German form is retained here as being familiar; and as yet in most general use.

Serfs, Villeins, and Villeinage. Throughout the Middle Ages and in many countries down to modern times, the lowest class of the agricultural population held an *unfree* status, and were described in England as serfs or villeins. It used to be customary to distinguish between *serf* and *villein*, the former being regarded as an absolute slave, and the latter as occupying a position midway between serf and freeman. Such a distinction existed in early times, but it is not frequent in *Domesday Book*, and it disappeared in the thirteenth century. During the period of the Middle Ages about which we have most knowledge, serf and villein were equivalent terms descriptive of status or condition. This circumstance was partly due to the emancipation of the older slaves, and partly to the degeneration of the villein class, which, owing to social and economic conditions, sank deeper into bondage. The villein was in a state of dependence upon his lord, who was the owner of his person and of his goods, and he could be bought and sold. He was usually an agricultural labourer, and he might be moved from one estate to another, or employed in any kind of service at his lord's option; if he tried to escape, the law would help his lord to recover him. But he was not himself a mere chattel, and by the custom of the estate or manor on which he lived he had certain recognized rights, though these could not be enforced against his lord in any court. He generally held land in villeinage, that is, in return for rendering certain services; these services were clearly defined, and the definition would tend to be respected as 'the custom of the manor'. He had, however, no access to any court except that of his lord; the law of the land gave him no protection either for his holding or for his personal property against his lord, who also had the power of imprisoning him. But, unless the lord had a special grant of judicial authority from the Crown, he could not deprive the villein of life or limb, and the courts of the land came to give protection to a villein's property against others than his lord. A distinction was drawn between the status of villein and the form of tenure known as villeinage. A free man might hold land in villeinage, i.e. on condition of the performance of villein services, but this did not make him a villein. He did not, however, have any right in such land of a kind which a court of law would protect against the lord of the manor, nor could he alienate it without the lord's consent. Men became villeins by birth, or by acknowledging their unfree status; the latter course was adopted by free tenants whom poverty made incapable of fulfilling the conditions of their free tenure.

The number of villeins decreased in England in the fourteenth century owing to economic causes, but after the Black Death there was a scarcity of labour, and landlords enforced old obligations of villeinage. This attempt led to the Peasants' Revolt of 1381. Little was gained by the revolt, but economic causes reasserted themselves and villeinage decreased in the fifteenth century. But it was still a sufficiently widespread grievance to be a powerful factor in Robert Kett's rebellion in 1549, and it is calculated that in Elizabeth's reign there were still at least 250 villein families in England. As late as 1561 the burgh of Norwich surrendered a youth on the ground that he was a villein. Agricultural villeinage died out much earlier in Scotland, and in the end of the sixteenth century the memory of its existence had been lost, for the great lawyer, Sir Thomas Craig, denied that villeinage had ever been known in the kingdom. On the other hand, conditions very similar to villeinage persisted among Scottish miners and salters until near the end of the eighteenth century. In France traces of serfdom remained until the Revolution, and Louis XVI emancipated the last serfs on the royal domain. The attempt of the German serfs to obtain their freedom in the Peasants' War, which accompanied the Reformation, was a complete failure, and serfdom continued in Germany until comparatively recent times. The Emperor Joseph II abolished serfdom in Bohemia, Moravia, Galicia, Silesia, and Hungary in 1781; in Prussia serfdom continued until the publication of the Emancipation Edict of 1807, and even after that many local efforts were made to evade its terms. In Russia serfdom was not abolished until 1861.—BIBLIOGRAPHY: T. K. Ingram, *History of Slavery and Serfdom*; F. Seebohm, *The English Village Community*.

Serge, a name common to a great number of fabrics, but chiefly given to worsted cloths woven with the 2/2 twill weave. These fabrics are used mostly for suits and costumes for both sexes. They are usually woven natural colour, and then dyed according to requirements; the blue serge is the most common type. Fancy serges are woven with bolder twills, those made from cotton yarns being used as linings for different garments. Serges are also made from silk yarns.

Sergeant, a superior non-commissioned officer. Originally the word was *serviens*, and first came into use in the Middle Ages in the days of the Free Companies. The first bearers of the title were the servants or assistants of the knight or commander of the company, and as such were responsible for conveying his orders to the men. Gradually a rank intermediate between the sergeant and the knight was evolved, i.e. sergeant-major or second in command. In the seventeenth century the *sergeant-major general* was an officer of high rank in the army. In more modern times the sergeant-major is a warrant officer and the sergeant a non-commissioned officer. The rank is common to all arms of the service, with the exception of the Household Cavalry, whose senior non-commissioned officers are known by the appellation of corporal of horse.

Sergipe, a maritime state of Brazil, north of Bahia; area, 15,089 sq. miles. The coast is low and sandy, but the interior is mountainous. The chief river is the São Francisco on the north. Cotton, sugar-cane, rice, tobacco, &c., are grown, and the woods furnish good timber, dyewoods, and quinine. Pop. 535,090. The chief town is Aracajú.

Serie'ma, or **Crested Screamer** (*Cariama cristāta*), a crane-like bird of the size of a heron inhabiting the grassy plains of South America. Its feathers are grey, and a crest rises from the root of the beak, consisting of two rows of fine feathers curving backwards. The eye is sulphur-yellow, the beak and feet red. It utters a loud screeching cry. The seriema is protected in Brazil on account of its serpent-killing habits, and is often domesticated. The Chunga (*Chunga burmeisteri*) of the Argentine, a smaller bird, is closely related.

Series, in mathematics, primarily an array of terms, as $u_1, u_2, u_3, \ldots u_n, \ldots$, where u_n is given as a function of n, i.e. can be calculated by an assigned rule, when n is given. The form of this rule determines the character of the series; for the simplest types, see *Arithmetical*; *Geometrical Progression*; *Harmonical Progression*. A series is *finite* or *infinite* according as the number of its terms is limited or unlimited. A finite series can always be *summed*. An infinite series is said to be *convergent* when the sum of n terms tends to a limit (q.v.) when n increases indefinitely; the limit, when it exists, is called the *sum* of the series. When the limit does not exist, the series is called *divergent*. The sum of n terms of a divergent series may increase indefinitely as n increases, as in the example $1 + 1 + 1 + \ldots$. The sum may, however, remain finite without tending to a definite value independent of n, as in the series $1 - 1 + 1 - 1 + \ldots$, or in the series whose nth term is $\sin nx - \sin(n - 1)x$, the sum of n terms of which is $\sin nx$; a series of this type is said to *oscillate*. *Asymptotic* series are divergent series which can be used to evaluate functions of very large numbers.

Series Motor. For a general account, see *Electric Motors*; *Rheostat*.

In a series motor the magnetic field is created by the main current. The cable used for the field coils must be of large cross-section, as it carries all the current, but as the strength of the magnetic field depends upon both the current and the number of turns of wire, and the current is large, only a few turns of wire are required.

When the motor is working, there are magnetic lines of force passing not only through the copper conductors, but also through the iron of the core of the armature, the rotating part, and also of the poles and magnet frame, which are stationary. Electric pressures are generated within this iron during the continuous changes in position as the armature revolves. To prevent such actions causing large currents, known as eddy or Foucault currents, which would overheat the motor as well as waste the power, the armature is always made up of numbers of thin plates of iron or laminations, which are insulated from each other by varnish, thin sheets of paper, or in some cases by the mere coating of oxide upon their surfaces. The commutator of an electric motor is made up of separate bars of copper insulated from each other. The bars are connected to the ends of the coils on the armature, and the currents passing through the brushes flow through the bars to the coils in the direction required to make the rotation possible.

When the load upon a series motor is increased, the current passing through the armature and also the field coils is increased. The wires on the armature convey greater currents and operate in a correspondingly stronger magnetic field. This action makes this type of motor a very suitable one for use where suddenly imposed loads and starting under load are conditions of running. Such requirements are commonly found in traction work on both tramways and railways, and also with cranes. When a train or tramcar is running up an incline, a considerable load is imposed upon the motors, but as they are series wound, the speed falls, and a sufficient torque or turning moment is exerted to meet the demand without an inordinate load upon the power station.

Alternating-current motors of similar type to the direct-current motor have met with a considerable amount of success, although their introduction, because of many design difficulties, was at a much later date. The field frame of the direct-current motor is replaced by a wound stator; that is, the rotor is surrounded by a circular and fixed structure with slots on its inner periphery, in which the coils are embedded. At any instant the current flows in the coils in one half of the stator from front to back, while in the other half the reverse condition holds. This type of motor is frequently provided with other coils, known as compensating coils, to overcome some of the disturbing magnetic actions found under certain common conditions of running.—BIBLIOGRAPHY: *Modern Electrical Engineering* (Gresham Publishing Company); the English translation by G. W. O. Howe of Thomälen, *Electrical Engineering*; J. W. Meares, *Electrical Engineering Practice*.

Seringapatam' (properly **Sri-ranga-patanam**, 'city of Vishnu'), a town of Mysore, India, on an island formed by two branches of the Kaveri. It was once the capital of Mysore, and was a stronghold of Tippoo and Haidar Ali. In 1799 it was stormed and carried by assault by British troops, Tippoo himself being slain. Pop. 7000, once 140,000.

Seri'phos, or **Serpho**, an islet of the Cyclades, yielding corn and wine; iron ore is mined. It furnished several vessels to the Athenian fleet in the battle of Salamis, and was used as a place of exile by the Romans. Pop. 4000.

Serjeant-at-arms, in England, one of the officers who attend the person of the sovereign to arrest offenders of distinction, &c. Two of them attend on the two Houses of Parliament, and each has a deputy, their duties being to apprehend any offender at the injunction of the House. On certain occasions the Lord Mayor of London is allowed the attendance of a serjeant-at-arms.

Serjeant-at-law, in England, formerly a barrister of the highest rank. The serjeants-at-law formed a special order or brotherhood, and took precedence over all the other barristers. They were appointed by the Crown, and were selected from barristers of not less than sixteen years' standing. In court they were distinguished by a special dress. The judges in common law formerly were always selected from the serjeants. The society was dissolved in 1877, and Lord Lindley (died in 1921) was the last serjeant-at-law. See *Coif.*

Serous Membranes are double membranes lining certain cavities and the organs they contain. Thus the pleura is a lining for the inner aspect of the chest wall, and also a lining over the lungs; the peritoneum is a lining for the inner aspect of the abdominal wall, and as well a lining over various of the abdominal organs. The action of the serous membranes is to allow movement of the organ without friction, and between the two layers a certain amount of serous fluid is exuded to assist this. The membranes are liable to become inflamed, and pleurisy and peritonitis arise as the result of inflammation of the pleura and peritoneum.

Serpentine, a mineral hydrous silicate of magnesium and iron, $H_4(Mg,Fe)_3Si_2O_9$, derived almost entirely from the alteration of olivine in igneous rocks or metamorphosed limestones. Olivine-rocks and other peridotites decay by subterranean or surface action into serpentine-rocks, which are commonly called by the mineral name serpentine. Serpentine has a hardness of only 2·5, and can be cut with a knife; it is green, or often stained red or black, in streaks and patches, through the separation of iron oxide. Massive serpentine is in consequence cut, or even turned in a lathe, and is polished as a handsome ornamental stone. Since the hydration of its original minerals continues when it is exposed to moisture, it should not be used for external decoration. Serpentine often occurs in granules, bands, or large masses in altered limestones. The magnesium may have been in such cases derived from dolomite, and the silica from impurities or by diffusion from some igneous source. See *Chrysotile.*

Serpents, or **Snakes** (Ophidia), an order of reptiles, characterized by an elongated and cylindrical body covered with horny scales, but never with bony plates. There is never any breast-bone nor pectoral arch, nor fore limbs, nor as a rule any traces of hind limbs. In a few cases, however (as in the python), rudimentary hind limbs may be detected. The ribs are always numerous, some serpents having more than 300 pairs. These not only serve to give form to the body and aid in respiration, but are also organs of locomotion, the animal moving by means of them and of its scales, which take hold on the surface over which it passes. The vertebræ are formed so as to give great pliancy, most if not all serpents being able to elevate a large portion of their body from the ground. Snakes have curved, conical teeth, not lodged in distinct sockets, useless for mastication, but serving to hold their prey. In the typical non-poisonous or innocuous serpents, both jaws and the palate bear continuous rows of solid conical teeth. In the venomous serpents, as vipers, rattlesnakes, &c., there are no teeth in the upper jaw excepting the two poison fangs. These are long, firmly fixed in a movable bone, above which there is a gland for the elaboration of poison. Each tooth is perforated by a tube through which the poison is forced. The tongue, which is forked, and can be protruded and retracted at pleasure, is probably rather an organ of touch than of taste. The eyelids are fused into a transparent curtain covering the front of the eye, but separated from it by a tear-chamber. No external ear exists. The nostrils are situated on the snout. The heart has three chambers, two auricles and a ventricle. The digestive system comprises large salivary glands, a distensible gullet, stomach, and intestine, which terminates in a cloaca with a transverse external opening. A urinary bladder is absent. They are either oviparous or ovoviviparous, the eggs being either hatched externally or within the animal's body. Many serpents, especially the larger species, as the boas, subsist on prey thicker than themselves, which they crush by constriction, and which they are able to swallow from the throat and body being capable of great dilatation. The order is divided into nine families, by far the largest of which, Colubridæ, contains mainly harmless forms, together with others, especially cobras, of poisonous nature. The Viperidæ possess only two poison fangs in the upper jaw. They are only absent from the Australian region and Madagascar, and all the included species are venomous, among them being vipers and rattlesnakes. See *Reptiles*; *Rattlesnake*; *Python*; &c.

Serpents, Isle of, (*Insulă Şerpilor*), a Roumanian island in the Black Sea (45°16′ N. lat. 30°14′ E. long.) off the Sulina mouth of the Danube. It is uninhabited but for a Roumanian patrol, and possesses a lighthouse 71ft. high and visible for 18 miles. At the congress of Berlin (1878) Roumania was compelled to cede to Russia her possessions in southern Bessarabia, and received the Isle of Serpents as a part of her compensation.

Ser′pula, a genus of Annelida or segmented worms, inhabiting cylindrical and tortuous calcareous tubes attached to rocks, shells, &c., in the sea. Its head segments are provided with plume-like gills or branchiæ. Though without eyes, it is extremely sensitive to light.

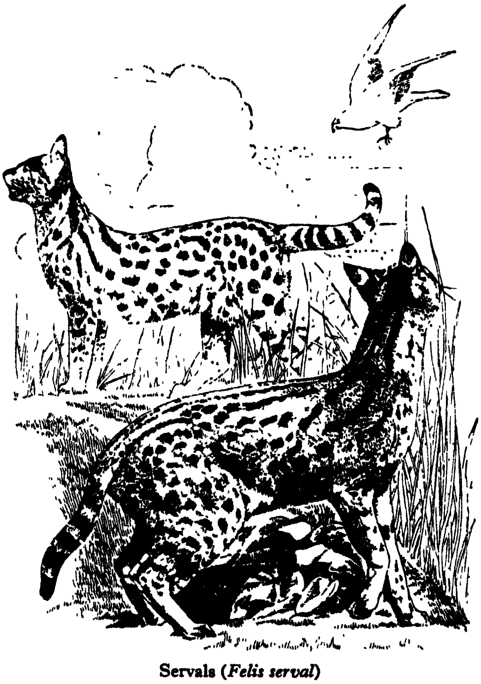
Serto′rius, Quintus, Roman soldier, born about 120 B.C., died 72 B.C. In the quarrel between Sulla and Marius he sided with the latter. When Sulla returned from the Mithridatic War (83 B.C.), Sertorius was proscribed and fled.

The Mauritanians having risen against their king, he led them to victory, and was afterwards asked by the Lusitanians to take command of their troops against the Romans. Opposed to much superior forces, he displayed the talents of a skilful general, and successfully resisted the Roman leaders Metellus and Pompey. He was treacherously assassinated at a feast by his friend Perperna.

Sertula'ria, or **Sea-firs**, an order of Hydrozoa (q.v.), common on the British coasts.

Serum, a part of the blood plasma, the fluid portion of the blood. When blood coagulates, the clot is formed of blood corpuscles and fibrin —the other part of the plasma—and the straw-coloured fluid in which the clot floats is the serum.

Serval, **Bush-cat**, or **Tiger-cat** (*Felis serval*), a carnivorous mammal nearly related to the leopard, a native of Africa. Its general colour is a bright-yellow, with a greyish tint, and marked with black spots. The average length is about 3 feet, including the long bushy tail. The serval is readily domesticated, and its fur is in great request.



Servals (*Felis serval*)

Serve'tus, Michael (properly *Miguel Servede*), Spanish theologian, born in 1511, died in 1553. Having formed views of the trinity antagonistic to the orthodox doctrine, he removed to Germany, where he printed a tract entitled *De Trinitatis Erroribus* (1531), followed a year later by his *Dialogorum de Trinitate Libri duo.* He subsequently studied medicine, graduated as doctor in Paris, and practised for three years at Charlieu, near Lyons. In 1553 he published his matured theological system under the title of *Christianismi Restitutio* (Restoration of Christianity). He was arrested for heresy and imprisoned, but contrived to escape, and purposed to proceed to Naples, when he was apprehended at Geneva. Calvin was especially urgent and emphatic as to the necessity of putting him to death. As he refused to retract his opinions, he was burnt at the stake on the 27th Oct., 1553. Servetus was one of the first anatomists to find out something about the circulation of the blood.

Service Tree (*Pyrus domestica*, or *Pyrus Sorbus*; nat. ord. Rosaceæ, sub-order Pomeæ), a European tree from 50 to 60 feet high. It has imparipinnate leaves, whitish beneath; flowers in clusters, cream-coloured, and resembling those of the hawthorn; fruit a reddish-coloured berry (about the size of a small gooseberry), which, like the medlar, is only pleasant in an over-ripe condition. The wood is very hard, and easily takes on a brilliant polish. The wild service or *sorb* (*Pyrus torminalis*) is somewhat similar to this.

Servitude, in civil and Scots law, much the same as an easement (q.v.) in English or American law.

Servius Tullius, the sixth King of Rome. According to the tradition, he was the son of a slave, given by the elder Tarquin to Tanaquil, his wife. He married Tarquin's daughter, and on the death of his father-in-law (578 B.C.) he was raised to the throne. He defeated the Veientines and the Etruscans, and divided the population of Rome into tribes, instituting at the same time the *comitia centuriata* and *tributa*; he also beautified the city, and built several temples.

Ses'amum, or **Ses'ame** (Sesamum), a genus of annual herbaceous plants, nat. ord. Pedaliaceæ. They have alternate leaves and axillary yellow or pinkish solitary flowers. *Sesamum orientāle* and *S. indicum* are cultivated, especially in India, Egypt, and Syria; they have also been introduced into America. The oil expressed from the seeds is of fine quality, and is often used as a salad-oil, also known as *gingelly-oil* and *benné-oil.*

Ses'sile (Lat. *sessilis*, from *sedeo*, *sessum*, to sit), in zoology and botany, a term applied to an organ attached or sitting directly on the body to which it belongs without a support; as, a *sessile leaf*, one issuing directly from the main stem or branch without a petiole or footstalk; a *sessile flower*, one having no peduncle; a *sessile gland*, one not elevated on a stalk.

Session, Court of, also called the **College of Justice**, the highest civil judicatory in Scotland, established by James V in 1532. It consists of thirteen judges: the lord president, the lord justice-clerk, and eleven ordinary lords. The court is divided into an inner and an outer house. In the former sit the lord president and three ordinary lords forming the first division, and the lord justice-clerk and three other ordinary lords forming the second division. The remaining ordinary lords sit in the outer court and hear cases singly. The outer house is a court of first instance, the inner house one of appeal. The judgments of inferior courts, except those of the small debt courts, are mostly subject to the review of the Court of Session. Judgments of the Court of Session may be appealed against to the House of Lords. The judges are appointed by the Crown *ad vitam aut culpam.*

Sester′tius, an ancient Roman silver coin worth 2½ asses. The sestertius was the fourth part of a denarius, and was worth about 2*d.* sterling.

Set-off, in English law, the right which a defendant in an action has to set against the demand of the plaintiff any claim which he has against the plaintiff. The claim set-off need not be in any way connected with the demand of the plaintiff, but it must be liquidated and enforceable at law, and it must not have arisen since the commencement of the action. The right is entirely statutory, and was first given by the Act, 2 Geo. II, c. 22, s. 13. The similar right existing in Scots law is known as compensation (q.v.).

Setter, a breed of dogs, so named from their habit of crouching or ‘ setting ’ on scenting game. The distinct races are the English, Irish, and Gordon setters. The first has soft silky hair without curl, and considerable feather fringing both fore and hind legs; colour variable, black-and-white, orange-and-white, liver-and-white, &c.; outline elegant; prominent forehead; long, wide nose; ears smaller than a pointer's, with some silky hair; eyes animated and intelligent; chest deep rather than wide. The Gordon setter is black-and-tan, with some features of the collie and the bloodhound; the Irish setter is of a rich chestnut colour.

English Setter

Settlement, in law, (1) a deed by which property is settled; specially the general will or disposition by which a person regulates the disposal of his property, usually through the medium of trustees, and for the benefit of a wife, children, or other relatives; or the disposition of property at marriage in favour of a wife. (2) Legal residence or establishment of a person in a particular parish, town, or locality, which entitles him to maintenance if a pauper, and subjects the parish or town to his support. The *primâ facie* settlement of a pauper is the place of his birth, and this remains his settlement until he has acquired another settlement, which may happen in England in any of the following ways: A legitimate child under parental authority may acquire a new settlement by a change of settlement on the part of his father, or after his father's death on the part of his mother. An illegitimate child, however, follows the settlement of his mother up to sixteen years of age, or until he acquires another for himself. A married woman takes the settlement of her husband, and retains it after his death. A settlement may also be acquired by renting for at least one whole year a tenement of the value of at least £10, and paying the poor-rate, and residing in the parish in which the tenement is situated for at least forty days; or by being apprenticed and residing during such apprenticeship for at least forty days in any parish. Finally, a settlement may be acquired by residence for one year in another parish than that in which one was born. The Scottish law of settlement requires a person to have resided three years in another parish than that in which he was born before he can acquire a settlement in such other parish. See *Poor and Poor Laws.*

Setu′bal, or **St. Ubes**, a seaport of Portugal, on the Bay of Setubal, at the mouth of the estuary of the Sado; served by rail from Pinhal Novo. It exports lemons, olives, oil, wine, and great quantities of salt. Pop. 30,000.

Sevenoaks, an urban district and market town of Kent, England. There is a grammar-school dating from 1432. Pop. 9300.

Seven Sleepers, seven Christian youths of Ephesus who, according to an old legend, were condemned to be buried alive in a cave during the Decian persecution (A.D. 250). Nearly 200 years afterwards a herdsman accidentally found his way into the cave, and the sleepers awoke. One of them was sent to the city to buy bread, and was astonished to find the cross displayed over the city gates. On tendering a coin of the time of Decius for the bread which he bought, he was arrested, and taken before the authorities to explain his possession of such ancient money. He told his story, and led his accusers to the cave, where his companions were found. The Emperor Theodosius II at once went to see the strange wonder, and was told by the youths that God had brought them to life again to confirm his faith in the resurrection of the dead. Having delivered their message, they again fell asleep. A full account of the legend is given by Gibbon in his *Decline and Fall of the Roman Empire*, chapter xxxiii.—Cf. S. Baring-Gould, *Curious Myths of the Middle Ages*.

Seven Wise Masters, the title of a collection of early Oriental tales which had a wide currency during the Middle Ages. All the stories are connected with the fate of a king's son, and are somewhat similar to the tales in the *Arabian Nights* (q.v.).

Seven Wise Men, or Seven Sages of Greece. As generally set down they were Periander of Corinth, Pittacus of Mitylene, Thales of Miletus, Solon of Athens, Bias of Priēnē, Chilo of Sparta, and Cleobūlus of Lindus. Maxims of prudence and elementary morality are regarded as embodying a summary of their wisdom. Among these maxims are, ' Know thyself ', ' Nothing in excess ', ' Consider the end ', &c.

Seven Wonders of the World, an old designation of seven monuments, remarkable for their splendour or magnitude, generally said to have been: the pyramids of Egypt, the walls and hanging gardens of Babylon, the temple of Diana at Ephesus, the statue of the Olympian Zeus at Athens, the Mausoleum at Halicarnassus, the Colossus of Rhodes, and the Pharos or light-house of Alexandria.

Seven Years' War. The Seven Years' War of 1756–63 was largely the result of the ambition of the Empress Maria Theresa to regain Silesia, the greater part of which had been taken from Austria by Prussia in the preceding European conflict. The French, who had been allied with Prussia, were jealous of the success of their ally, and began to discuss an alliance with their traditional enemy, Austria. A treaty between Frederick II of Prussia, and Great Britain, gave the French Government a strong argument in favour of an Austrian alliance, and in May, 1756, France and Austria made the Treaty of Versailles. This ' Diplomatic Revolution ', which regrouped the Powers of Europe, was immediately followed by the outbreak of war between Great Britain and Prussia on the one hand, and France and Austria on the other, but, while Prussia had to fight Austria, and afterwards Russia, the effort of Great Britain was directed almost entirely against France, and the chief events were in India and North America and on the seas. (See *India*; *Canada*; *Chatham*; *Clive*; *Wolfe*.) In the campaign of 1756 Frederick made a successful invasion of Saxony, whose Elector would not promise neutrality, and he treated the country as a conquered province. Russia, under the Empress Elizabeth, joined France and Austria, and in the summer of 1757 Frederick, who had invaded Bohemia and won the battle of Prague, was defeated (June) at Kolin and forced to retreat. In the following month the Duke of Cumberland, the victor of Culloden, who was in command of a Hanoverian army, was defeated at Hastenbeck, and led his army into so dangerous a position that he made the Convention of Kloster Seven, by which his force was to remain out of action for the rest of the war. The agreement made Hanover defenceless against the French, to whom it opened the road to Berlin, and after the French general, trusting to the Convention, had moved away, George II repudiated Cumberland's agreement. Frederick himself retrieved the situation. In November he defeated the French at Rossbach and prevented them from entering Saxony, and in December he crushed the Austrians at Leuthen and recovered Silesia, which they had occupied. In 1758 the Hanoverian army, under Ferdinand of Brunswick, held its own in the west, but Frederick's invasion of Bohemia was stopped by the necessity of meeting a Russian invasion of Brandenburg. He defeated the Russians at Zorndorf (August), but the Austrians, under Marshal Daun, attacked the Prussians in Saxony, whither Frederick at once marched. He was defeated at Hochkirch (October), but retained possession of Saxony.

The year 1759 brought misfortunes to Prussia in the east and in Saxony, where, after the battle of Kunersdorf (August), Frederick lost Dresden, but in the same month Brunswick, with the help of British troops, won a great victory over the French at Minden, which saved Hanover. Frederick's resources were failing, and in June, 1760, a Prussian army was defeated at Landshut, in Silesia, which was held by two Austrian armies. Frederick, who had been engaged in an unsuccessful siege of Dresden, crushed one of these armies at Liegnitz (August) and prevented a junction with a Russian force which had also entered Silesia. But Austrians and Russians invaded Prussia and sacked Berlin, and the Austrians were recovering Saxony. Frederick again retrieved an almost desperate situation by defeating the Austrians under Daun at Torgau, in Silesia, and driving them into Saxony, where they retreated to Dresden, leaving the greater part of Saxony in Frederick's hands. The year 1761 was all but fatal to Prussia. Brunswick held the French in the west, and Frederick met with no disaster during the summer, but in October Silesia was occupied by the Austro-Russians, and Eastern Pomerania by the Russians. Not less serious than these military disasters was the fall of Pitt and the formation of the ministry of Bute in Great Britain, and the threatened withdrawal of the subsidies which had financed the Prussian armies, largely composed of foreign mercenaries. At the end of 1761 Frederick himself said that he was lost unless fortune worked a miracle in his favour. On 5th Jan., 1762, his great enemy, the Empress Elizabeth, died, and her successor, Peter III, not only made peace with Frederick and restored the territory occupied by the Russians, but actually sent troops to help him against the Austrians. Peter was forced to abdicate in July, but his short reign had saved Frederick. Sweden, which had joined the coalition against Prussia, also made peace. Austria was exhausted, and Frederick could face the withdrawal of the British subsidies and the negotiation of a separate treaty between Great Britain and France. He won his last victory at Burkersdorf, in Silesia, in July, and recovered most of the province, and his brother, Prince Henry, won the battle of Freiburg, in Saxony. A truce was followed by the Peace of Hubertsburg between Prussia and Austria (Feb., 1763), on the basis of a restoration of the *status quo*, Frederick restoring Saxony, and Austria evacuating Glatz, in Prussian Silesia. The Treaty of Paris between Great Britain, France, and Spain (which had entered the war in accordance with the Third Family Compact in 1761–2) was signed on the same day—the treaty by which Great Britain gained Canada and several West Indian islands and secured predominance in India. France and Prussia had never declared war on each other, though French and Prussians had fought at Rosbach, and no treaty was therefore necessary, but, in the preliminaries of the Treaty of Paris, the French undertook to evacuate the Prussian possessions which they had occupied in the Rhineland.—BIBLIOGRAPHY: C. T. Atkinson, *History of Germany in the 18th Century*; F. W. Longman, *Frederick the Great and the Seven Years' War*; T. Carlyle, *Frederick the Great.*

Severn, the second largest river in England, formed by the union of two small streams which rise in Mount Plynlymmon, Montgomeryshire. It flows through Montgomeryshire, Shropshire, Worcestershire, and Gloucestershire, passing the towns of Newton, Welshpool, Shrewsbury, Worcester, Tewkesbury, Gloucester, and Bristol, and after a circuitous southerly course of about 210 miles falls into the Bristol Channel. It receives the Tern, Upper Avon, and Lower Avon on the left, and the Teme and Wye on the right. Below Gloucester especially, banks are required to protect the adjacent lands from the bore, which not infrequently attains a height of 9 feet. A railway tunnel 4½ miles long has been driven below the river from near Avonmouth, in Gloucestershire, across to Monmouthshire, and a railway bridge 3581 feet long crosses the river at Sharpness higher up.

Seve'rus, Lucius Septimius, Roman emperor, born near Leptis, in Africa, of a noble family, A.D. 146, died at York A.D. 211. Under Commodus he commanded the legions in Pannonia, and on the murder of Pertinax in March, 193, was proclaimed emperor by his troops. Severus accordingly marched to Rome to subdue the partisans of Didius Julianus, who was, however, soon assassinated by his own soldiers. Severus then marched to the East against Pescennius Niger, who had also been elected emperor by a powerful army. After many obstinate battles Niger was routed on the plains of Issus (A.D. 194). Severus then returned to Rome, and attempted to assassinate his rival, Albinus, commander of the Roman forces in Britain, by his emissaries, but when this had failed of success, he met him in battle on the plains of Gaul, near Lyons (Feb., 197), and was again victorious. Severus, with his two sons, Caracalla and Geta, now marched to the East to repel an invasion of the Parthians, and subjugated Seleucia, Babylon, and Ctesiphon. After subduing an insurrection in Britain, and building a stone wall from the Tyne to the Solway Firth as a defence against the incursions of the Caledonians, he died at York.

Severus, Wall of. See *Roman Roads and Walls.*

Sévigné (sā-vēn-yā), Marie de Rabutin-Chantal, Marquise de, French writer, born in 1626, died in 1696. In 1644 she married the Marquis de Sévigné, who was killed in a duel in 1651, leaving her the mother of a son and a daughter. In 1669 her daughter, to whom she was extremely attached, married the Comte de Grignan, and shortly afterwards accompanied her husband to Provence. A seven years' separation from her daughter gave rise to the greater part of the *Letters* which have gained Madame de Sévigné so much reputation. They are models of the epistolary style, perfectly natural from their expression, lively sentiment and description, and a playfulness which gives grace and interest to trifles. The first edition of her *Letters* (which were never intended for publication) appeared at The Hague in 1726. —BIBLIOGRAPHY: Sainte-Beuve, *Portraits de femmes*; A. J. Thackeray Ritchie, *Madame de Sévigné*; Janet Aldis, *Mme de Sévigné, Queen of Letter Writers.*

Sevilla, an inland province of Southern Spain. In general, it consists of fertile plains, producing cereals, seeds, vegetables, oranges, and other fruits; wine, oil, and tobacco. Large numbers of horses are reared. The chief river is the

Guadalquivir. Minerals include iron, silver, lead, and copper. The chief exports are wheat, barley, oranges, oil, wool, and copper. Area, 5428 sq. miles; pop. 626,920.

Sevilla, or **Seville**, a city and archiepiscopal see of Andalusia, Spain, capital of the province of Sevilla. The principal building is the Gothic cathedral, begun in 1402 and finished in 1506. Attached to it is the famous Moorish Giralda. This tower is capped by a dome bearing a bronze figure of Faith; height, 308 feet. There is a Roman aqueduct (410 arches), a university, a library founded by the youngest son of Columbus, and a collection of pictures by Murillo, in his own house. The manufactures include silks, hemp goods, porcelain, soap, cork, chocolate, leather, and especially tobacco and cigars. The river is navigable for vessels of considerable size up to the city; a good trade is carried on, large quantities of oranges, iron ore, lead and lead ore, zinc ore, copper pyrites, and corks being exported, largely in British bottoms.

Sevilla is one of the most ancient cities of Spain, and was known to the Phœnicians as *Sephala.* Julius Cæsar gave it the title of *Julia Romula.* It was the residence of the Gothic kings before they moved to Toledo in the sixth century. It surrendered to the Moors in A.D. 712, and remained in their possession till 1248, when Ferdinand III, King of Castile, after a year's siege, forced Sevilla to open its gates to him. At this time it is said to have contained 600,000 inhabitants; and upon the capitulation 300,000 Moors abandoned the city. After the discovery of America it became the centre of the commerce of the New World, and was very flourishing; but the superior advantages of the port of Cadiz induced the Government to order the galleons to be stationed at the latter place, and from that time it declined. In 1810 the city surrendered to Soult, but in 1812 was retaken by the British. In 1843 it was besieged for nine days, and capitulated to Espartero. The remains of Columbus were transferred to the cathedral from Havana in 1899. Velasquez and Murillo were natives of Sevilla. Pop. 150,630.

Sèvres, a town of France, in the department of Seine-et-Oise, near St. Cloud, on the Seine, the home of the French porcelain industry. The porcelain of Sèvres is unrivalled for brilliancy of colour and delicacy of execution. Down to 1769 the Sèvres chinaware was of soft porcelain alone, and is known as *Old Sèvres*; now it is of hard porcelain. The national factory has been State property since 1759. Pop. 8000.

Sèvres, Deux, a department of France, bounded by Maine-et-Loire, Vienne, Charente, Charente-Inférieure, and Vendée; area, 2337 sq. miles. A branch of the Cevennes traverses the department from south-east to north-west. Cereals, leguminous crops, and hops are grown. Viticulture and forestry are carried on. Minerals include iron and limestone. The principal manufactures are linen and cotton goods, serge, flannel, woollen hosiery, and gloves. The capital is Niort. Pop. 310,060.

Sèvres, Treaty of, a peace treaty between the Allies and Turkey, completed on 10th Aug., 1920. Its provisions included the cession of Thrace, excepting the Sanjak of Chatalja, and Constantinople to Greece, and the transfer to the Greek Government of sovereign rights over a special area around Smyrna. Certain Ægean islands were also ceded to Greece; the Hejaz was recognized as independent; the protectorate by Britain over Egypt, the Sudan, and Cyprus was recognized; Kurdistan became practically autonomous; Armenia was constituted a free, independent state; and all Turkish rights over Morocco, Tunisia, Libya, and the Dodecanese were surrendered. The Straits, including the Bosporus, Sea of Marmara, and the Dardanelles, were to be opened to free navigation at all times by all military and commercial air-craft, or naval or mercantile vessels, without distinction of flag. Certain clauses related to the protection of minorities in Turkey and the limitation of Turkish armaments, and there were also financial and economic clauses. The Treaty of Sèvres was modified by Mustafa Kemal's campaign, and by the Conferences of Mudania and Lausanne during 1922 and 1923.

Sewage. *Sewers.*—At the outset the conveyance of sewage from buildings is effected by a system of private drains that simply carry forward the liquid waste-matters from the various points of discharge into the street sewers. Through the latter the flow of the sewage continues until the point is reached where it is either discharged in its crude state into some watercourse, or, as is more generally the case, subjected to some form of treatment before being finally discharged into a river or stream. In many instances the purification of sewage is made compulsory, but there are many districts that have not yet introduced sewage-purification schemes.

Sewage Purification: Natural Methods.—The simplest method of sewage purification is to discharge the sewage in regulated volumes over suitable areas of land, when nature will carry out the purifying process. The soil is teeming with minute forms of life, and these organisms carry out this beneficent work in their own way. This mode of treatment is known as sewage irrigation, where crops are grown upon land that is periodically flooded with sewage. Treatment by irrigation, however, is not often practicable, owing to the difficulty of acquiring land of the right kind in suitable situations, and of sufficient area. There are also difficulties associated with the working of sewage farms, with the result that artificial methods of purification are chiefly resorted to, both in the case of large and of small schemes.

Artificial Methods.—All artificial methods of sewage purification require a much smaller area of land than the natural process indicated above. From an engineering standpoint there are fewer limitations in the case of artificial methods, and almost any kind of land will do, provided it is suitably located and of sufficient size. The most widely adopted systems are those which involve some form of preliminary tank treatment, after which the sewage is made to flow through biological filters.

Chemical Treatment and Artificial Filtration.—In a large scheme, the sewage at the outset is discharged into a main catch-pit, where the heavier solids accumulate, whilst rough bar screens intercept the grosser floating matter. Smaller particles of insoluble matter are frequently intercepted by special forms of screens arranged in duplicate, so that one set may be in operation whilst the other set is being cleansed. For removing the heavier solid matter from the catch-pit, travelling dredgers are frequently used. From the catch-pit the sewage flows along channels to large precipitation tanks, whilst into these channels chemical reagents (such as milk of lime, sulphate of iron, &c.) are introduced to aid the sludge to settle out of the sewage as it flows through the tanks. From the chemical precipitation tanks the sewage is distributed in different ways over biological filters before being finally discharged into the nearest watercourse. The sludge from the precipitation tanks is disposed of either by barging it out to sea and dumping it there, or pressing it into the form of cake and selling it, or trying to sell it, as artificial manure.

Septic-tank Treatment and Artificial Filters.—In this process the preliminary treatment is carried out in a septic tank (a cesspool of special construction and form), where liquefaction of the organic solids takes place. The effluent from the tank is afterwards passed through biological filters, as in the previous case, and finally discharged into any adjacent river or watercourse.

Septic-tank and Contact-bed Treatment.—This is one of the early artificial processes of sewage purification. Preliminary treatment by septic tanks is carried out as previously described, but instead of passing the effluent downwards through biological filters, the contact beds are flooded with sewage, and the latter kept in contact with the medium with which they are charged for about two hours. After the period of contact, the sewage effluent is discharged into any available stream, and the beds left to aerate for a few hours. The purifying process of contact beds is due to the action of bacteria and low forms of life, as in the case of biological filters. Contact beds are operated in cycles, that is, a period is allowed them in which to fill; another period for remaining full; another period in which to empty; and the last period for the aeration of the medium of which the body of the bed is composed.

Activated-sludge Process.—The modern tendency in sewage-purification work is in the direction of concentrative methods, and the activated-sludge process is typical of this form of development.

In the activated-sludge process the sewage first flows into a chamber or tank in which the mineral or irreducible matter is intercepted. After leaving the grit-chamber, the sewage flows along special channels of considerable length, during which passage it is agitated either by revolving paddles that are fixed in the channels, or by means of compressed air flowing through perforated pipes or nozzles fixed along the bottom of the channels. After leaving the channels (which are arranged in the form of bays), the sewage flows into *humus tanks* of considerable depth, the sewage inlets to these being submerged, whilst the effluent is discharged at surface outlets.

At the present stage of development it is considered that further purification by the aid of biological filters is not required after the effluent has left the humus tanks.

Seward (sū′ård), Anna, born 1747, died at Lichfield, where most of her life was spent, 1809. She was intimate with Erasmus Darwin, and gained an unaccountable reputation as a poet.

Seward, William Henry, American statesman, born 1801, died 1872. In 1838 and 1840 he was chosen Governor of New York, and in 1849 was elected to a seat in the United States Senate. He strongly opposed the extension of slavery. In 1860 he was a candidate for the presidency, but Lincoln was elected, and nominated Seward as Secretary of State for Foreign Affairs. He was dangerously wounded in April, 1865, when Lincoln was assassinated, but recovered and fulfilled the same office under Lincoln's successor, Andrew Johnson. He resigned his post on the accession of President Grant in 1869.

Sewel′lel (*Haplodon rufus*), a small rodent of North America, inhabiting California, Oregon, &c. It is about 12 inches long, and is allied to the beavers and also to the marmots.

Sewing-machines. The replacement of hand labour in sewing has attracted the attention of inventors from the end of the eighteenth century. The earlier machines used hooked needles, which were passed through the fabric and caught the threads, which were then drawn through the material. Such arrangements proved very unsatisfactory, as the strands of the cloth were caught by the hooks. About the same time machines were patented which had needles with an eye in the middle and points at each end. Pincers were used in these models to grip the needle above and below the fabric alternately.

In 1830 Thimmonier and Ferrand devised machines which produced what is termed chain stitching. The disadvantage of this system was that if the end of the thread was pulled the whole of the seam became undone.

Elias Howe, a poor American mechanic, designed the first satisfactory and practical sewing-machine, and patented his invention in 1841. In this machine two threads were employed, one passing from the reel through the eye of the needle, and the other being obtained from a small shuttle. The stitches were firmly locked, and the disadvantages of the old-style chain stitch entirely overcome. This principle has been adhered to in most of the later machines, but many improvements in detail have been effected.

I. M. Singer, an American, devised a machine in 1854 in which the attempt to get over the disadvantages of the chain stitch was made by tying a knot in the thread after every eighth stitch.

The present-day sewing-machine is the outcome of the work of many inventors; in fact the sewing-machine has proved one of the most popular fields for inventors. Appliances for the effecting of the suitable stitches for hemming, plaiting, cording, braiding, tucking, ruffling, and many other processes are now available for use on the standard machines of commerce. The motion for the mechanism is obtained from turning by hand, the foot-working of a treadle with a crank and connecting-rod mechanism, or by the drive from an electric motor, either direct or through the medium of shafting.

The manufacture of sewing-machines was one of the first processes to which repetition working was applied in engineering. The parts are all standardized, and many of the operations are performed with the assistance of jigs (q.v.). The manufacturing costs have been considerably reduced in this way, and the natural result has been the universal employment of machines for all classes of sewing work. The detail construction and operation of each machine is described in the handbooks supplied by the manufacturing companies.

Sex Disqualification (Removal) Act. The Reform Act of 1918 (8 Geo. V, c. 64) gave to women a large measure of enfranchisement; the Act 8 and 9 Geo. V, c. 47 admitted them to membership of the House of Commons; and on 23rd Dec., 1919, there passed into law the Sex Disqualification (Removal) Act, which provided (Section 1) that a person should not be disqualified by sex or marriage from the exercise of any public function, or from being appointed to or holding any civil or judicial office or post, or from entering or assuming or carrying on any civil profession or vocation, or for admission to any incorporated society (whether incorporated by Royal Charter or otherwise), and should not be exempted by sex or marriage from the liability to serve as a juror. There are, however, two provisos to this section of the Act, namely: (1) there may be reserved to men such posts in the civil service in any of the British possessions overseas or in any foreign country as His Majesty by Order in Council may provide; and (2) a judge may order that a jury be composed of men alone or of women alone as the case may require, or may exempt a woman from service on a jury in respect of any case by reason of the nature of the evidence to be given or the issues to be tried. Section 2 of the Act provides for the admission of women as solicitors; while Section 3 gives power to university authorities to admit women to membership, or to any degree, right, or privilege, notwithstanding anything in the statutes or charter of such university. Lastly, Section 4 provides that any enactment, Order in Council, Royal Charter, or provision, so far as inconsistent with the provisions of the Act, shall cease to have effect.

Thus women, if duly qualified, have the right equally with men to be judges, justices of the peace, members of the House of Commons, barristers, solicitors, and jurors. But military and ecclesiastical offices are still closed to women, and the House of Lords jealously guards its ancient privileges, a petition by Lady Rhondda for authority to take her seat being refused in 1922 by the Committee for Privileges.

Sextant, an instrument for measuring angles, chiefly used for taking altitudes (q.v.) at sea. In the diagram (fig. 1) the sextant is seen to consist of a sector of a circle PQ, rather more than a sixth of the circumference (whence the name *sextant*). Pivoted at C, the centre of the circle, is a brass index-arm IA, with a vernier *v* at its outer end. Mounted rigidly at C on this arm, with its face perpendicular to the plane of the circle and in the centre-line of IA, is a plane mirror I, called the index-glass. The vernier moves along the scale of angles engraved on PQ. The scale is numbered from Q towards P from 0° to 120° or farther. H is another plane mirror facing O, with only the lower half silvered, as shown in elevation at K. This is called the horizon-glass, and is fixed so as to be parallel to I when the vernier is at zero. At O is a ring into which a telescope may be fixed. When the altitude of a star is to be taken, the sextant is held vertically, and the arm IA turned until the image of the star, formed by successive reflections from I and H, is seen on the horizon, which is visible through the unsilvered part of H. On land an artificial horizon (q.v.) may be used. The altitude of the star is easily shown from the law of reflection (see *Light*) to be twice the angle through which the arm IA has been turned from the zero position.

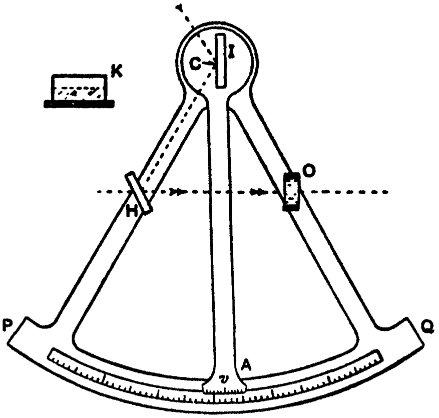


Fig 1.—Sextant

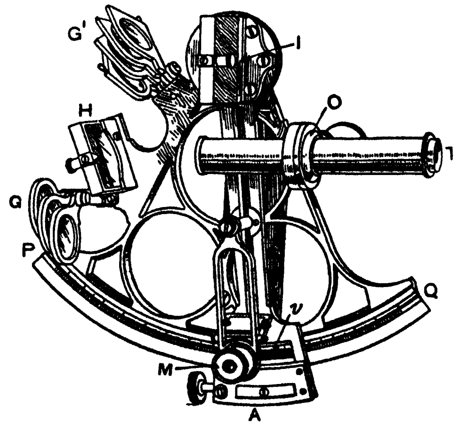


Fig. 2.—Sextant

G, G^1, Shade glasses for use in observing the sun. M, Magnifying glass for use in reading the vernier. T, Telescope.

Sextus Empir'icus, Greek physician and philosopher, who flourished in the first half of the third century A.D. As a philosopher he was the greatest of the later sceptics. We have two works by him, written in Greek, one, entitled *Outlines of Pyrrhonism*, explains the method of Pyrrho; the other, entitled *Against the Mathematicians*, is an attempt to apply that method to all the prevailing philosophical systems and other branches of knowledge.

Sexual Selection, the term used by Charles Darwin for his brilliant suggestion in explanation of the meaning of the secondary sexual characters and the part they play in the processes of reproduction and evolution. More than two-thirds (part ii) of *The Descent of Man, and Selection in Relation to Sex* (1871) is devoted to the discussion of the secondary title, which Darwin himself shortened to the phrase *sexual selection.* At the present time, misrepresentation of Darwin's views is so widespread that it is desirable to quote his own words in elucidation of his own theory. " With animals which have their sexes separated, the males necessarily differ from the females in their organs of reproduction; and these are the primary sexual characters. But the sexes often differ in what Hunter has called secondary sexual characters, which are not directly connected with the act of reproduction." Sexual selection " depends on the advantage which certain individuals have over others of the same sex and species solely in respect of reproduction ". " When the two sexes follow exactly the same habits of life, and the male has the sensory, or locomotive organs, more highly developed than those of the female, it may be that the perfection of these is indispensable to the male for finding the female; but, in the vast majority of cases, they serve only to give one male an advantage over another. Since in such cases the males have acquired their present structure, not from being better fitted to survive in the struggle for existence, but from having gained an advantage over other males, and from having transmitted this advantage to their male offspring alone, sexual selection must here have come into action. It was the importance of this distinction which led me to designate this form of selection as Sexual Selection." After referring to the animals in which the males have acuter senses than the females, to enable them the more readily to find the latter, or are quicker in their movements so that in pursuit they can overtake the females, or are provided with prehensile organs so that they can seize and hold them, Darwin goes on to say: " There are many other structures and instincts which must have been developed through sexual selection—such as the weapons of offence and the means of defence of the males, for fighting with and driving away their rivals—their courage and pugnacity —their various ornaments—their contrivances for producing vocal or instrumental music— and their glands for emitting odours, most of these latter structures serving only to allure or excite the female. It is clear that these characters are the result of sexual and not of ordinary selection, since unarmed, unornamented, or un-attractive males would succeed equally well in the battle for life and in leaving a numerous progeny, but for the presence of better endowed males."

Darwin's brilliant theory undoubtedly offers an explanation of a vast number of biological facts which were incomprehensible before 1871; and even now, it cannot be denied that his suggestion is the only one which offers a reasonable interpretation of the facts.—Cf. E. S. Goodrich, *The Evolution of Living Organisms.*

Seychelles (sā-shel′), a group of about ninety islands and islets in the Indian Ocean, ranging between lat. 3° 40′ and 5° 35′ s., and long. 55° 15′ and 56° E. They were first occupied by the French, and were ceded to the British in 1814. The settlers are mostly of French extraction. The largest island is Mahé (55½ sq. miles); others are: Praslin, Silhouette, Curieuse, Félicité, and La Digue; dependencies are: the Cosmoledos, Providence I., Astove I., Assumption I., Aldabra I., Coetivy, Farquhar Islands, Flat I., the Amirantes, St. François, St. Pierre, &c. Coco-nuts, cotton, coffee, cocoa, vanilla, tobacco, maize, rice, and the cinnamon tree (for oil) are cultivated; and coco-nut oil, soap, vanilla, tortoise-shell, coffee, cocoa, and guano are exported. Phosphates are worked in places. The capital is Victoria, a coaling-station with a good harbour. Pop. 24,500.

Seymour (sē′mur), the name of a noble English family of Norman origin. Their name is corrupted from St. Maur, which was their seat in Normandy. They acquired lands in Monmouthshire in the thirteenth century, and early in the fifteenth century acquired others in Somersetshire. The first conspicuous member of this family, Sir John Seymour, was the father of the third wife of Henry VIII (q.v.), and of Edward Seymour, who, on his sister's marriage in 1536, was raised to the peerage as Viscount Beauchamp, and subsequently became Earl of Hertford and Duke of Somerset. (See *Edward VI.*) Somerset was arrested in Oct., 1551, on a charge of treasonable designs against the lives of some of the Privy Councillors. He was tried, and beheaded on Tower Hill in Jan., 1552.—His brother, Thomas, Lord Seymour of Sudeley, was made a peer and Lord High Admiral of England by the Protector. He married Catherine Parr, widow of Henry VIII, and was continually plotting against his brother. In 1548 he was attainted of treason, and he was executed in 1549.—The eldest son of the Protector was created by Elizabeth Earl of Hertford, and the grandson of this Earl of Hertford, having distinguished himself in the Royalist cause, obtained in his favour the revival of the title of Duke of Somerset in 1660.—Cf. A. A. Locke, *The Seymour Family.*

Sfax, a seaport-town of Tunisia, on the Gulf of Gabes; served by railway to Tunis. It exports large quantities of fruit, wool, sponges, phosphate, esparto, &c. Pop. 40,000.

Shabats, a town of Serbia, Yugo-Slavia, on the Save. There is a school of agriculture, and a weekly market for live-stock, cheese, and grain. Shabats was twice entered by the Austrians in 1914 (European War), and evacuated on both occasions; they again took possession in Sept., 1915, and retired in Nov., 1918. Pop. 15,000.

Shackleton, Sir Ernest Henry, British polar explorer, born in Ireland in 1874, died in 1922. As a mercantile-marine officer he joined Scott's National Antarctic Expedition of 1901 (*Discovery*), and from 1907 to 1909 he commanded the British Antarctic Expedition (*Nimrod*), penetrating to within 97 miles of the South Pole. On his return he was knighted and made C.V.O. From 1914 to 1917 he commanded the *Endurance* expedition, and was Director of Equipment and Transport in North Russia, 1918–9. In Sept., 1921, he sailed in command of the Shackleton-Rowett Expedition (*Quest*), and succumbed to an attack of *angina pectoris* on 5th Jan., 1922. He was buried in South Georgia. His published works include *Heart of the Antarctic* and *South.*

Shad, a name of several fishes of the family Clupeidæ or herrings, and including two British species, the common or allice shad (*Clupea alosa*) and the twaite shad (*C. finta*). The common shad inhabits the sea near the mouths of large rivers, which it ascends in spring to spawn. Its colour is a dark-blue above, with brown and greenish lustres, the under parts being white. The twaite shad is about a half less than the common species, and weighs on an average about 2 lb. A widespread American species (*C. sapidissima*), varying in weight from 4 to 12 lb., is an important food fish.

Shaddock (*Citrus decumāna*), sometimes called *pompelmoose* or *pomelo*, a large species of orange, attaining the diameter of 7 or 8 inches, with a white, thick, spongy, and bitter rind, and a red or white pulp of a sweet taste, mingled with acidity. It is a native of China and Japan.

Shadwell, Thomas, English dramatist, born about 1642, died in 1692. Educated at Cambridge, he studied the law for some time at the Middle Temple, and then visited the Continent. On the recommendation of the Earl of Dorset he was created Poet Laureate in the place of Dryden, whose bitter enmity against Shadwell found expression in his severe satire of *Mac Flecknoe.* Shadwell is also the Og of *Absalom and Achitophel.*

Shaftesbury, Anthony Ashley Cooper, first Earl of, English statesman, born in 1621, died in 1683. He succeeded to a baronetcy on the death of his father in 1631. After leaving Exeter

College, Oxford, he studied law at Lincoln's Inn, and was chosen representative for Tewkesbury in 1640. At the commencement of the Civil War he supported the Royal cause, but advised mutual concession. Finding that in consequence of this opinion he was distrusted by the court, he joined the Parliament, and received command of its forces in Dorsetshire. After the deposition of Richard Cromwell he aided the restoration of Charles II with all his influence, and in 1661 was created Baron Ashley, and appointed Chancellor of the Exchequer and a Lord of the Treasury. He afterwards became a member of the obnoxious Cabal. In 1672 he was created Earl of Shaftesbury and Lord High Chancellor. His conduct on the bench was able and impartial, but he was deprived of office, probably through the influence of the Duke of York; and he at once became one of the most powerful leaders of the opposition. In 1678 he took a prominent part in the attacks on Catholics during the Popish Plot scare. In 1679 he became President of the Council, and the same year was instrumental in passing the Habeas Corpus Act. In 1681 he was indicted for high treason but acquitted. He entered into the plots of the Monmouth party and had to fly to Holland, where he died. He is the Achitophel of Dryden's famous satire.—Cf. W. D. Christie, *Life of Shaftesbury* (2 vols.).

Shaftesbury, Anthony Ashley Cooper, third Earl of, grandson of the preceding, English philosopher and moral writer, born 1671, died 1713. In 1708–9 he published several works of a philosophical character, among others a *Letter on Enthusiasm* and an *Inquiry concerning Virtue or Merit.* His writings were collected and published together under the title of *Characteristics of Men, Manners, Opinions, and Times.* In 1716 and 1721 collections of his correspondence were published. In all his works Lord Shaftesbury showed himself a firm believer in the fundamental doctrines of natural religion; but, although he professed a respect for Christianity, he was sceptical in regard to revelation.—Cf. James Martineau, *Types of Ethical Theory.*

Shaftesbury, Anthony Ashley Cooper, seventh Earl of, English philanthropist, born 1801, died 1885. He was educated at Oxford, and sat in the House of Commons from 1826 to 1851, when he succeeded to the peerage. He zealously laboured to improve the condition of the labouring classes. His name is chiefly associated with factory legislation.

Shagreen′, a species of untanned leather prepared from horse, ass, and camel skin, the granular appearance of its surface being given by embedding small seeds in it whilst soft, and afterwards shaving down the surface, and then by soaking causing the portions of the skin which had been indented by the seeds to swell up into relief. It is usually dyed green. It is now commonly made of the skins of sharks or rays.

Shah Jehan, the fifth Mogul emperor of Delhi, reigned from 1627 to 1658, when he was deposed by his son Aurangzib. During his reign the Mogul Empire attained a great magnificence; he founded Delhi, where he erected the celebrated peacock throne, and built the Taj Mahal at Agra.

Shairp, John Campbell, Scottish critic and poet, born 1819, died 1885. He became principal of St. Andrews University in 1868. From 1877 he also held the chair of poetry at Oxford. His works include: *Kilmahoe, a Highland Pastoral, and other Poems*; *Poetic Interpretation of Nature*; *Burns*, in the English Men of Letters Series; and *Aspects of Poetry.*

Shakers, a communistic society founded in America in 1776 by Ann Lee, an expelled Quaker. The Shakers give themselves the formal designation of "Believers in Christ's Second Appearing". Property is held in common, and celibacy is enjoined upon all, and married persons, on entering the community, must live together as brother and sister. During their religious worship the Shakers march round the hall, dance to the singing of a hymn, and clap their hands. They agree with the Quakers in their objection to taking oaths, and in the rejection of the Sacraments.

Shakespeare, William, England's and the world's greatest dramatic poet, was born in 1564, and died in 1616. The exact date of his birth is not known; he was baptized on 26th April, and the traditional date of the 23rd was assigned to his birthday because of the fact that three days was a customary interval between birth and baptism. The 23rd April, moreover, was certainly the date of Shakespeare's death, as well as the day sacred to England's patron saint. Shakespeare was born at a house in Henley Street, Stratford-on-Avon. This house is still preserved, though it somewhat resembles the stuffed horse of Wallenstein at Prague, of which it was said: "The head, neck, legs, and part of the body have been repaired—all the rest is the real horse". John Shakespeare, the poet's father, came to Stratford from Snitterfield about 1551. He was a fell-monger and glover, probably also a butcher, and certainly a dealer in corn and timber. The variety of his employment has puzzled some of his son's biographers, but in those days specialization was the exception, not the rule. As far as can be made out, John Shakespeare was of a merry disposition, had a taste for litigation, and was not over-prudent in the management of his worldly affairs. In 1557 he married Mary Arden of Wilmcote, who owned a small estate known as

Asbies, as well as having an interest in two messuages at Snitterfield. The children of the marriage were: two daughters (Joan and Margaret), who died in infancy; William (1564–1616); Gilbert (1566–1612); Joan, afterwards Mrs. Hart (1569–1646); Ann (1571–1579); Richard (1574–1618); and Edmund, an actor (1580–1607).

It is almost certain that Shakespeare was educated at the free grammar-school at Stratford. There has been much difference of opinion about the exact amount of education he received; but there is every reason to believe that Ben Jonson's famous phrase about "small Latine, and lesse Greeke" was a purely relative expression. The plays and poems of Shakespeare owe much to the classics. Especially in his early plays, he showed that "Seneca cannot be too heavy, nor Plautus too light". One classical influence in particular—the influence of Ovid—permeates Shakespeare's work from Alpha to Omega—from *Venus and Adonis*, "the first heir of my invention", to a speech in the last act of *The Tempest*. There is little doubt that without being a finished scholar, or anything of a close student, Shakespeare had read many of the ordinary Latin authors, and was familiar with some of the Greek classics, possibly in Latin translations.

During Shakespeare's boyhood the prosperity of his father declined considerably. His fortunes had reached their zenith in 1568, when he was high-bailiff of Stratford. As far as this wave of adversity can be dated, it would seem to have begun when the poet was about fourteen. John Shakespeare mortgaged the farm at Asbies, sold first his wife's share and then her reversionary interest in the Snitterfield property, was deprived of his alderman's office, and finally was arrested. It is probable that William was taken away from school earlier than he would have been had his father's affairs continued to prosper. It is uncertain how he spent the next few years. Seven cities claimed to be the birth-place of Homer; the professions or callings which claim Shakespeare as a member number seventy times seven. One doubtful tradition asserts that he was a schoolmaster in the country (presumably on the strength of his "small Latine"); another, equally doubtful, says that he was bound apprentice to a butcher. The legend that Shakespeare was in a lawyer's office is based upon a misinterpretation of a passage of Nash and an overestimation of the accuracy of the legal knowledge displayed in the plays. Members of the Inns of Court associated freely with actors and playwrights; and apart from that the eldest son of an inveterate litigant would absorb much legal knowledge without leaving the home circle.

Shakespeare's Birth-place, Stratford-on-Avon

Late in 1582 Shakespeare married Anne Hathaway. There is evidence that the bride's family was more in favour of the marriage than the bridegroom's. The eldest child, Susanna, was baptized on the 26th May, 1583. Anne Shakespeare was eight years older than her husband. On 2nd Feb., 1585, Shakespeare's twins, Hamnet and Judith, were baptized. Speculation as to the happiness or otherwise of Shakespeare's marriage is rendered valueless, but unfortunately not prohibited, by the absence of any evidence. It is likely that the marriage was less unhappy than it is popularly supposed to have been.

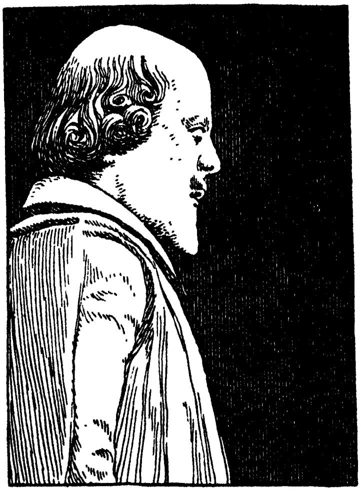
Late in 1585 Shakespeare left Stratford for London. The immediate cause of his leaving, according to his first biographer, Rowe (1709), was that he fell into ill-company, and was caught deer-stealing in the park of Sir Thomas Lucy of Charlcote, who prosecuted him. Shakespeare retaliated with a ballad, and Lucy in anger hounded him out of Warwickshire. Doubt has been, quite unnecessarily, cast upon this story, which is probably true in essence if not in detail. A young man of Shakespeare's temperament easily turns into an amateur poacher; and it is certain that Justice Shallow in *The Merry Wives* is a caricature of the pompous county magnate, Lucy.

It is not known how Shakespeare's connection with the stage began. A doubtful tradition says that he at first held the horses of playgoers during the performances. He had seen touring companies of actors at Stratford on several occasions; moreover, acting had all the charm of a new profession—in this respect resembling cinema-acting in the early twentieth century—and held out alluring prospects of speedy success. We do not know how good an actor Shakespeare was, but tradition credits him with having played Adam in *As You Like It*, the Ghost in *Hamlet*, and Old Knowell in Jonson's *Every Man in his Humour*, so that he would appear to have specialized in taking old men's parts. Soon after his arrival in London he began to refurbish old plays, and gradually was led on from minor to major alterations, and so to original work. By 1592 he was important enough to be attacked by the dying prodigal Robert Greene, in his *Groatsworth of Wit*, and to be apologized to by Greene's executor, Henry Chettle, in his *Kind-Hart's Dream*. In 1593 Shakespeare dedicated *Venus and Adonis* to the Earl of Southampton, and in the next year dedicated the companion poem *Lucrece* to the same patron.

On 11th Aug., 1596, Shakespeare's only son Hamnet was buried. On 20th Oct. of the same year a draft grant of arms was given to John Shakespeare; a second draft was given in 1599. On 4th May, 1597, Shakespeare bought New Place at Stratford from William Underhill for £60. In 1598 Shakespeare was praised in most flattering terms by Francis Meres in his *Palladis Tamia*, where twelve of the plays are enumerated, a priceless boon to Shakespearean chronologists. In 1599 the Globe Theatre was built on Bankside, and Shakespeare was made a partner in Burbage's company. John Shakespeare died in Sept., 1601. In May of the following year Shakespeare, who was now exceedingly prosperous, bought 107 acres of land in Old Stratford for the large sum, as it was then, of £320. In 1605 he bought for £440 the thirty-two years' term of the moiety of the lease of Stratford tithes. On 5th June, 1607, Susanna Shakespeare was married to John Hall, M.A., a prosperous physician of Stratford. Their only child, Elizabeth, was baptized on 21st Feb., 1608; Shakespeare's mother died the following September.

At some unknown date, possibly about 1611, Shakespeare retired from London to Stratford. In 1613 he bought for £140 a house and ground near Blackfriars Theatre, London. On 29th June, 1613, the Globe Theatre was burnt down during a performance of *Henry VIII*, and it is probable that the acting copies of Shakespeare's plays were destroyed. On 10th Feb., 1616, Judith Shakespeare was married to Thomas Quiney, a vintner of Stratford. Shakespeare's health began to fail about this time; he executed his will on 25th March, 1616, and died at New Place on 23rd April. His will was proved by his son-in-law, John Hall, on 22nd June. Anne Shakespeare died on 6th Aug., 1623. Judith Quiney bore three children, two of whom lived to manhood but died childless. Elizabeth Hall was Shakespeare's last descendant; she married Thomas Nash in 1626, and John Barnard (made a baronet by Charles II) in 1649. She died without issue by either marriage in 1670.

Only two likenesses of Shakespeare have any claim to be regarded as authentic—the bust at Stratford-on-Avon and the somewhat crude engraving by Martin Droeshout prefixed to the First Folio (1623). The numerous other likenesses, including a favourite one known as the 'Chandos', cannot be regarded as genuine.


The Bust at Stratford-on-Avon

The Poems

Venus and Adonis (1593) and *Lucrece* (1594) may be considered together, as they are companion pieces, both dedicated to the third Earl of Southampton. These poems are miniature epics, but are not successful as such. Shakespeare wished to graduate in poetry, and these two poems were his theses—his original contribution to poetry. It is clear that in both cases Shakespeare chose the subject; the subject did not choose him. Both poems are written in easy flowing verse, and both have vivid touches in them, and excellent descriptions of nature. The early poem is the livelier and more spontaneous of the two, but the later is more mature and is metrically superior. Both poems have some of the qualities that Leigh Hunt found in *Endymion* when he called it "a wilderness of sweets". Many readers will agree with Hazlitt, who called these two poems " a couple of ice-houses ". They seem to owe their origin less to inspiration than to the fact that 1593 was a year of plague, so that the theatres were closed and Shakespeare was idle.

A Lover's Complaint is attributed to Shakespeare solely because it was included in the first edition of the *Sonnets* (1609). It is almost certainly not by Shakespeare. It belongs to the gentle world of literary pastoral which Shakespeare nowhere else approached but to set it in conjunction with his own poetic realism. It is everything good and everything bad that is implied by the word ' pretty '.

The Passionate Pilgrim was published by William Jaggard in 1599. Its title seems in no way connected with its contents; a more suitable title would have been *The Impudent Pirate.* It was a piratical venture, containing two of Shakespeare's sonnets, three poems out of *Love's Labour's Lost,* four poems on the subject of Venus and Adonis, and miscellaneous songs by men like Barnfield and Griffin. It is in fact a miscellany raked together and floated with Shakespeare's name. The phenomenal success of *Venus and Adonis* gave rise to many imitations. It increased the humour of the situation as well as the sale of *The Passionate Pilgrim* to attribute some of these imitations to Shakespeare, just as the Greeks said that Homer was the author of the mock-Homeric poem *Margites.*

The Phœnix and the Turtle was printed in Robert Chester's *Love's Martyr* in 1601. It is a fine-sounding poem, and probably once had a meaning; but it is unintelligible now. It has the air of a trifle thrown off at the urgency of a resolute anthologist. Shakespeare was perhaps asked by Chester, a man devoted to allegory and emblems, to write this poem. With his usual gentleness he consented, but he could not refrain from regarding his task as a pleasant jest.

The *Sonnets* are the most beautiful and most important of Shakespeare's poems, but they present the thorniest problems in Shakespearean criticism. They were published piratically in 1609 by one Thomas Thorpe, who dedicated them " To the onlie begetter of these insuing sonnets, Mr. W. H.". The principal problems of the *Sonnets* are the identities of Mr. W. H., of the youth to whom many of the sonnets are addressed, of the dark lady mentioned in many of the poems, and of the rival poet mentioned in a few. But the master-problem which lies behind all these is ' How far are the *Sonnets* autobiographical? ' The answers to these questions are many and various. A good case has been made out by Sir Sidney Lee for identifying Mr. W. H. with one William Hall, a piratical publisher and friend of Thorpe's, but in no way connected with Shakespeare. Other theories identify him with Henry Wriothesley, third Earl of Southampton (on the same principle as that on which ' David Copperfield ' stood for ' Charles Dickens '); with the third Earl of Pembroke, William Herbert (this theory does not take into account the courtesy-title invariably given to an earl's eldest son); and with a boy-actor, William Hughes. This last theory was suggested by Tyrwhitt, and supported in characteristic fashion by Oscar Wilde. Hughes still remains, however, as nebulous a person as Mrs. Harris. The youth to whom many of the *Sonnets* are addressed is usually identified with Mr. W. H.; it is extremely probable that this identification is wrong, but it is likely enough that the youth is the third Earl of Southampton, to whom *Venus and Adonis* and *Lucrece* were addressed, and who was, as far as we know, Shakespeare's only patron. The dark lady has been identified with almost everyone—except Anne Hathaway. A theory that she was Mary Fitton—a fair-haired mistress of Pembroke's—on the *lucus a non lucendo* principle, does not meet with much acceptance now, though it was the orthodox theory some years ago. She has also been identified with Mrs. Davenant, Penelope, Lady Rich, and Queen Elizabeth. Many even wilder theories are suggested, e.g. that Shakespeare is a champion of Protestantism, the " worser spirit " being the Catholic Church and the " better angel " the Reformed—a theory hardly likely to commend itself even to the most thorough-going Orangeman. The rival poet is supposed to have been Daniel, or Marlowe, or Spenser, or Chapman, or Barnabe Barnes, or someone else.

All this speculation is more or less vain, and to most of the critics who write on the *Sonnets* a phrase of Ben Jonson's might be applied: " The one milks a he-goat, the other holds under a sieve ". The problem of the *Sonnets,* however, exercises upon the public mind the same fascination as the Man in the Iron Mask or *The Mystery of Edwin Drood.* It is extremely likely that, in the absence of further material evidence, the problem will never be solved. It is very probable that the autobiographical element in the *Sonnets* is either very small or so much transmuted from reality as to be of no value. It has been argued that the story unfolded in the *Sonnets* is not one which anyone would invent; but Petronius (*Sat.* § 113) has an almost identical situation: " Nec tamen adhuc sciebam, utrum magis puero irascerer, quod amicam mihi auferret, an amicae, quod puerum corrumperet ". If it be the case that ' the truest poetry is the most feigning ', it is possible that the characters in the *Sonnets* are fictitious characters; lay-figures which have come alive, quickened by the same mind that gave life to crude chronicle-plays and revenge-plays. It is not necessary to agree with Steevens, who said of the *Sonnets* that " the strongest Act of Parliament that could be framed would fail to compel readers into their service ", or with Hallam, who wished that they had never been written. There is no doubt, however, that different sonnets differ greatly in poetic value, some being supreme poetry and others mere literary exercises; and it is quite permissible to think that the *Sonnets* are a disconnected series of short poems in a more or less amorous vein, and that Shakespeare did not unlock his heart when composing them.

The Plays

One of the most interesting things about Shakespeare is that although he is so great he developed as though he had " no more wit than a Christian or an ordinary man has ". The discovery of the approximate order in which Shakespeare wrote his plays is perhaps the greatest contribution of the nineteenth century to Shakespearean scholarship. It is possible now to trace the growth of his mind and art.

Titus Andronicus (1588–90) is a crude experiment in melodrama, and is frequently said to be the work of Greene or Kyd. It was, however, ascribed to Shakespeare by Meres in 1598, and included in the 1623 Folio by Heminge and Condell. On the strength of these facts it is hard to deny that Shakespeare had a hand in it. Some critics make Shakespeare's share in this play equivalent to that of Hamlet in *The Murder of Gonzago, or the Mouse-trap*—" a speech of some dozen or sixteen lines which I would set down and insert in't ". It is probable that Shakespeare wrote considerably more than that amount of this play. Comedy was in a much higher state of development than tragedy in early drama—as much higher as Plautus is superior to Seneca. *Titus Andronicus* is no more below the mature tragedies than *The Comedy of Errors* is below the mature comedies. Aaron is a Shakespearean character. The play is obviously the work of a man learning his business, and is not imagined fierily. It is what the audience not what the author wanted, and is perhaps in the main the work of Shakespeare.

King Henry VI, Part I (1590–1) stands rather apart from Parts II and III of *King Henry VI.* It deals with the war in France, not with the Civil War, and contains much tentative writing. Great liberties are taken with history. Much of this play is dull and bombastic. It is almost certainly pre-Shakespearean for the most part, and may be the work of Greene and Peele. Possibly Shakespeare polished Greene's part and so aroused Greene's hostility. It is a relief to know that the odious scenes in which Joan of Arc is travestied are without doubt not by Shakespeare.

Love's Labour's Lost (1590) is a Lylyesque and highly amusing comedy of dialogue. Of all the plays it perhaps suffers most through lapse of time. It is obviously a young man's work, and deals with the two subjects which most interest young men—education and women. Shakespeare wrote this play to please himself, and evolved it entirely out of his own brain. He did not yet know enough about his own genius to understand that it suited him best to borrow his plots. A prodigality of wit and a want of selection characterize this play. Disraeli said of his own *Vivian Grey* that " Books written by boys which pretended to give a picture of manners and to deal in knowledge of human nature must necessarily be founded on affectation ". Affectation of one sort or another gives rise to most of the fun in this play, which is a plea against shaping our lives by narrow rules and artificial systems.

The Comedy of Errors (1591) is a skilfully constructed farce based upon the *Menæchmi* of Plautus. The *Menæchmi* may well have been some of the " small Latine " taught at Stratford Grammar School. One scene (Act III, Scene 1) was suggested by Plautus's *Amphitruo.* It was typical of Shakespeare's rapidly ripening genius to add a serious background to this play, and thus to make it look forward to *Pericles, The Winter's Tale,* and *The Tempest* in its story of lost relations finding each other. To the two Antipholuses Shakespeare added the two Dromios. The probable-impossible is, as Aristotle says, superior to the improbable-possible. By adding the two Dromios Shakespeare made his audience surrender entirely to the plot and to being amused. This is a good acting play, and is remarkable among the early plays for the rapidity of its exposition and its action.

The Two Gentlemen of Verona (1592–3) is a kind of overture to the great series of romantic comedies. In many ways it is inferior to *Love's Labour's Lost* and *The Comedy of Errors*, but it is greater in promise. In this play Shakespeare first showed his distinctive tone. It is badly constructed, intolerably slow in its exposition, and incredibly conventional in its ending. But real genius is shown in the drawing of the characters, especially in those of Launce and the Host. The preceding plays were the work of a clever young man; *The Two Gentlemen* shows forth clearly the young genius. There are three ingredients which go to make up a play—dialogue, plot, and characterization—and at first Shakespeare could only excel at providing these ingredients singly. *Love's Labour's Lost* excels in dialogue, *The Comedy of Errors* in plot, and *The Two Gentlemen* in characterization. In his next comedy Shakespeare excelled in all three, though undoubtedly helped by the dream-like nature of his subject.

A Midsummer-Night's Dream (1593–4) is the consummation of the early comedies. The skilful interweaving of the different threads of the plot is most noteworthy. It is one of the most original of all the plays, and one of the most beautiful; in fact it is one of the most beautiful things in the world; but its beauty is unsanctified beauty, just as Calverley, according to a Balliol don, was " unsanctified intellect ". This play is closely connected with *Romeo and Juliet*, which represents love in its tragic aspect, as *A Midsummer-Night's Dream* represents it in its fantastic aspect. Moreover, the plot of *The most Lamentable Comedy and most Cruel Death of Pyramus and Thisby* is extremely like the plot of *Romeo and Juliet*. It is probable that Shakespeare was putting his soul into these two plays while engaged on the more or less dull task of refurbishing the three parts of *King Henry VI*.

The Second and Third Parts of King Henry VI (1591–2) are usually considered to be only in part the work of Shakespeare. The Second Part is a recast of an older play, *The First Part of the Contention*, and the Third Part a recast of *The True Tragedie of Richard, Duke of Yorke*. It is usually believed that all these plays are the work of a Committee (something like that which revised the Bible between 1870 and 1884) of which Marlowe, Greene, Shakespeare, and Peele were members. It might well be thought impossible to assign to each contributor his exact share; nevertheless, many attempts to do so have been made. Critics who cannot detect an intentional parody can hardly be expected to detect a more or less unconscious imitation. It is probable that the young Shakespeare was looking about for a style, and, " circumsiliens modo huc modo illuc ", he wrote now in the style of one and now in the style of another. A passage in Stevenson's *Memories and Portraits* casts not a little light upon *King Henry VI* and its possible place in Shakespeare's development. " In *Monmouth*, a tragedy, I reclined on the bosom of Mr. Swinburne; . . . in the first draft of *The King's Pardon*, a tragedy, I was on the trail of no lesser man than John Webster; in the second draft of the same piece, with staggering versatility, I had shifted my allegiance to Congreve, and of course conceived my fable in a less serious vein." Later on in this same essay Stevenson calls his first words on paper " ventriloquial efforts " (cf. Aristophanes, *Wasps*, 1019). It is certain that there was collaboration in *King Henry VI*, but it is impossible to reconstruct the exact literary history of the plays.

King Richard III (1593) is the most Marlowesque of all the plays of Shakespeare. Marlowe's influence is greater in this play than in those in which he actually collaborated, just as Cæsar's influence in *Julius Cæsar* was greater after his death than before it. *Richard III* is a melodramatic play which stops at nothing to attain its effects. In Marlowe's fashion it has a dominating protagonist, and an opening soliloquy. Moreover, there is no growth in Richard's character; he is complete from the first, even as in real life he was (according to legend) born with all his teeth. *Richard III* was immensely popular; Burbage made his reputation in this play, which from an actor's point of view is a one-man play.

Romeo and Juliet (1591, perhaps revised 1596) is the tragic masterpiece of Shakespeare's first period. It is a far cry from *Titus Andronicus* to this play. Two of its most noticeable features are that it has no underplot, the main story moving unimpeded upon its course, and that it is filled with splendid poetry. Hitherto the poet and the dramatist in Shakespeare had worked turn about rather than collaborated; in this play they are fast allies. Hypercriticism has said that this play is a romantic story with a tragic ending rather than a tragedy, but it has the swift relentless logic that is the hall-mark of a tragedy.

King Richard II (1594) might be called anti-Marlowesque in its style. Shakespeare has definitely broken away from his discipleship to Marlowe, and is writing in his own style a play on a subject akin to that of *Edward II*. There is a lyrical element in this play which links it closely to *Romeo and Juliet*. Richard II, a king of shreds and purple patches, is splendidly drawn. He is a *poseur*, who rather enjoys making *De Profundis* speeches. There is a lack of comic scenes in this play, and prose is avoided.

King John (1595) is the greatest example of adaptation in the works of Shakespeare. It is based upon an old play, *The Troublesome Raigne of King John of England*, of which it retains much, while elevating much into poetry. It does not adhere closely to the facts of history. The older play was the work of a man who was patriotic, an intolerant Protestant, and an admirer of Marlowe. *King John* shows a more fervent patriotism, and a more tolerant attitude towards religion, and has definitely broken through the charmed circle of Marlowe. The Bastard is a great figure, and points the way to the cycle of histories that are founded upon humour and heroism.

The Merchant of Venice (1596) is an extremely popular play, which combined several different stories into one harmonious whole. It is possible that portions of this play were revised at a later date. The greatest figure in the play is undoubtedly that of Shylock. He has, through Kean's so potent art, been turned into a tragic figure, but there is no doubt that Shakespeare intended him to be the villain of the piece. The comic as distinguished from the tragic is a matter of the point of view from which the dramatist looks at his material, and the emphasis he gives it. The trial scene in *The Merchant of Venice* (which, by the way, is right in equity if wrong in law) is tragic if you look at it through the eyes of Shylock, comic if you look at it through the eyes of Gratiano. Some actors have emphasized Shylock's lines so deftly that the interruptions of Gratiano irritate more than they amuse.

King Henry IV, Parts I and II (1597–8), may be regarded as one play in ten acts. In this play the chronicle turns into the comedy of manners. This cycle of plays—the Lancastrian trilogy—is the most genial of all the Shakespearean cycles. From the dramatic point of view these plays are without construction, and there is no drama in them. But as comedies of manners they are unmatched and unmatchable. Falstaff is the most splendid comic character in modern literature. We can see him to some extent in the making. We see the first glimmer of the dawn of him in the cowardly knight, Sir John Fastolfe, of *King Henry VI, Part I*. We see him in his noon-tide splendour in *King Henry IV, Part I*; we see him in the afternoon of his glory in *Part II*. In *The Merry Wives* we see, as it were, his ghost. The question of why Henry V dismissed Falstaff is an interesting one. Shakespeare had to get rid of Falstaff from his play in order to write his national epic, *Henry V*. It is possible, however, that Falstaff obsessed Shakespeare no less than he obsessed and corrupted the prince. Berowne, the incarnation of youthful wit, is sent to jest a twelvemonth in an hospital; Falstaff, the incarnation of mellow humour, and on that account more dangerous, has to be disgraced and finally killed. Soon after the death of Falstaff, Shakespeare's genius turned to more serious themes.

King Henry V (1599) is the last of the historical plays. Its qualities are those of an epic rather than those of a play. Its dramatic interest is slender. Opinion has differed and probably always will differ about the character of Henry. He has been acclaimed as Shakespeare's ideal man; but he is probably only Shakespeare's ideal king. The young man who is purposely wild in order that subsequently he may make a more dramatic and effective entrance into public life, does not command our sympathy. In *Sonnet 94* Shakespeare has ironically praised a man of the type of Henry, and it is difficult to believe that he admired him.

The Taming of the Shrew (1597) is an adaptation of an earlier play, *The Taming of A Shrew* (published 1594). The later play is the statutory five acts. The authorship of *A Shrew* is one of the most interesting of Shakespearean problems. It has been assigned to every near and important predecessor of Shakespeare save Lyly and Nash. It has been suggested that Marlowe wrote it; but it is just as probable that Æschylus and Euripides collaborated to write the *Frogs*. All the Marlowesque lines are parody. Shakespeare's play is not to be taken too seriously. It has been said to delineate the tragedy which occurs when a manly spirit is born into a woman's body; but "'T were to consider too curiously to consider so". It has also been suggested that in the relationship between Petruchio and Katharina Shakespeare has portrayed his own marriage remoulded nearer to the heart's desire. Could Shakespeare hear this theory, he would give his laugh "broad as ten thousand beeves at pasture". The play is just a lively farce, the off-hand sketch of a mature artist, whose serious energies were concentrated on greater tasks.

The Merry Wives of Windsor (1598) is classed by some critics as the satyr-play of the Lancastrian trilogy, with Falstaff cast for the part of Silenus. According to an early eighteenth-century tradition, this play was written in fourteen days in obedience to a command of Queen Elizabeth, who wished to see Falstaff in love. Even Shakespeare could not write his best when writing to order, and Falstaff in love was a contradiction in terms. The play, however, is a bright, mirthful comedy, and is excellently constructed, being much better than *Henry IV* in this respect. It was almost certainly performed at Windsor, and probably on St. George's (Garter) day. Falstaff was transplanted into Elizabethan times, nor does he bear a much closer resemblance to his namesake in *Henry IV* than Hudibras does to Don Quixote.

Much Ado about Nothing (1598) is the earliest of the three great romantic comedies. In *The Merchant of Venice* Shakespeare had combined several plots of different kinds with great skill. In this play he has performed the still more difficult feat of repeating the same theme with variations, without monotony. The piece might be called a fugue, in which 'Much Ado' is the theme. Shakespeare's great gifts, however, have made this play unequal. The realism of the Benedick and Beatrice scenes shows up the unreality of the melodramatic Hero story. The play has thus in a lesser degree the same faults as those of *Measure for Measure.*

As You Like It (1599), the sunniest and most open-air of all the plays, was based on Lodge's prose tale *Rosalynde, Euphues Golden Legacie,* published nine years earlier. Lodge's novel was a medley in which many elements were intermingled but not interfused; Shakespeare's play is an harmonious whole. It reads as if Shakespeare had written it when weary of the city and needing recreation after finishing his great series of historical plays. It is full of the spirit of romance; and the dainty wit of Touchstone, the wisest fool in Shakespearedom, illuminates the whole play.

Twelfth Night (1600) is the acme of Shakespearean comedy. It has all that is most mirthful and exquisite in *Much Ado* and *As You Like It,* with something of added mirth and grace. Like its own clown, Feste, it "can sing both high and low". If one can appreciate only low comedy, one will enjoy in the story of Malvolio only the practical joke played on him; if one can also appreciate high comedy, one will like the delightful contrast between what Malvolio thinks himself and what he really is; between the effect he thinks he is producing on Olivia and the real effect. To treat Malvolio as an almost tragic personage is an absurd mistake made by some actors.

Julius Cæsar (1601) is the first of the Roman plays based on Plutarch, whom Shakespeare treated with more respect than he did Holinshed. It is a play without a hero, but with a number of heroic characters. There is a certain air of austerity about it, partly perhaps due to the lack of women in it. It is probable that Shakespeare spent an unusual amount of time upon this play. The language and thought are exquisitely clear, and are more evenly balanced than in any other play. Antony's speech (so often repeated that, like a set form of prayer, it has almost lost its meaning) is the cleverest thing in Shakespeare, a marvellous *tour de force.*

Hamlet (1602) is perhaps the most popular of the plays. Aristotle, when he says that the object of a tragedy is to purge pity and fear, goes on to say that fear is aroused by the misfortune of a man like ourselves. The popularity of *Hamlet* is due to the fact that everyone thinks he is Hamlet. The play is undoubtedly based upon an old revenge-tragedy, probably the work of Kyd. The question of whether Hamlet was mad or sane has called forth quite a library of monographs, and the conclusions reached have been succinctly summed up by Gilbert:

> Hamlet is idiotically sane,
> With lucid intervals of lunacy.

Hamlet's mother had just made a marriage which even the Deceased Wife's Sister Act has failed to legitimize. He is suffering from what mediæval preachers called *accidia,* a kind of morbid lethargy, which in his case is aggravated by misogyny. There is really little mystery in the character of Hamlet, except what has been read into it by commentators. At the same time, certain remains of the fabric of the old play and of the first version lead to some minor inconsistencies.

All's Well that ends Well (? 1601) is a curious play with an uncertain literary history. Parts of it are immature, both in style and metre, and parts of it are certainly Shakespeare's mature work. It is perhaps a recast of an earlier play, which many critics identify with *Love's Labour's Wonne,* mentioned by Meres in 1598. It returns to the subject of *Venus and Adonis*—a woman wooing a boy. The blending of styles makes this play unique. Parolles is Shakespeare's only Jonsonian character. He is a personified 'humour', and is drawn in two dimensions only. This play has come alive in parts, and the result is not altogether pleasant.

Measure for Measure (1603) is a powerful but not a lovable play. It is the most indoors of all the plays. It is to be noted that it is immeasurably less tragic than its source. *Measure for Measure* is the greatest example of a blemish which is found also in *Much Ado* and *All's Well.* Had a lesser man than Shakespeare written a play based on the plot of *Measure for Measure,* it would probably have passed muster, because, in Dr. Johnson's words, everyone would know "that the stage is only a stage, and that the players are only players". In Shakespeare's hands the story becomes so real that the conventional ending seems a sin against both art and morality.

Troilus and Cressida (? 1603) is the most obscure of Shakespeare's plays, and for that reason not without its admirers, as Persius, Browning, and Meredith have their admirers. It is full of worldly wisdom, but has not the heavenly wisdom of *Cymbeline* and *The Tempest.* It is ambiguous even in its position in the Folio, where it occupies a kind of limbo between the histories and the tragedies, and is not mentioned in the table of contents. In some respects it is like *Romeo and Juliet* eked out by 'more matter, with less art'. It is almost certainly a mixture of early and late work. Shakespeare, when following the greatest of all epic poets and the greatest of all his English predecessors, should have produced a fine play. *Troilus and Cressida* is undramatic, and owes such unity as it has to its all-pervading cynicism.

Othello (1604) is the greatest of all the plays, and is the most tremendous effort of Shakespeare as a dramatist. It is a sublimation of the domestic tragedy. It is based upon a powerful but crude story of Cinthio's—a story no more essentially tragic than the story of *Arden of Feversham* or *A Yorkshire Tragedy*. Out of this unpromising material Shakespeare has made the greatest of his plays. In construction it is as perfect as a play of Sophocles. Coleridge contrasted this play favourably with *Hamlet* and *Lear*, where, he said, there was something gigantic and unformed; in *Othello* " everything assumes its due place and proportion, and the whole mature powers of his mind are displayed in admirable equilibrium ".

King Lear (1605) is the most titanic of all the plays, and is the most tremendous effort of Shakespeare as a poet. It combines rapidity with length. It has the fire and the sublimity of the best work of Æschylus. This magnificent play is founded upon a nursery-tale. Shakespeare may have got a few hints for it in an old play, *The True Chronicle History of King Lear*, a play preferred to *King Lear* by Count Tolstoi. In this play we see the first signs of that lack of verbal and metrical restraint which is so notable in the latest plays.

Macbeth (1606) is a sublimation of the melodrama. It is, unfortunately, one of the worst printed plays of all the series, and has been a happy hunting-ground for textual critics of little or no ability. One of the most remarkable features of this play is its extreme rapidity. It goes straight to its *dénouement*; like to the Pontic Sea it keeps due on. This play was written to please James, hence the subject was taken from Scottish history, and hence the allusions to demonology, upon which the king had written a book, and to the healing of scrofula by means of the royal touch.

Antony and Cleopatra (1607) is a sublimation of the chronicle-play. It is slightly defective in construction, and lacks an absorbing centre of interest. There is no rousing incident until the play is far advanced. The scenes which are most memorable are those which are least essential to the plot. Coleridge, however, characterized this play as *feliciter audax*, and said it was a formidable rival of *Macbeth, Lear, Hamlet*, and *Othello*. It was perhaps rather hastily written, and has the excellences and defects of rapid work. Cleopatra is the greatest of Shakespeare's women, and the most complete psychological study in all the plays.

Coriolanus (1608) is a sublimation of the one-man drama. It is to be contrasted with *Richard III* and the plays of Marlowe. There is a Roman austerity about this play, which gives some of its scenes a somewhat statuesque effect. In no play of Shakespeare's is there less of the lyric manner. The play adheres most faithfully to Plutarch. Shakespeare emphasizes the futility of war by representing it as a kind of game, and endows Coriolanus with some of the gifts of a sergeant-major. *Coriolanus* is much less tragic than its immediate predecessors, as when the hero dies he loses his life but saves his soul. This is significant as marking the end of the tragic period.

Timon of Athens (? 1607–8) is a puzzling and chaotic play. Parts of it are in Shakespeare's most majestic style, and parts seem to be the work of an unskilful journeyman; but the difficulty of separating the wheat from the tares is greater in this than in any other play. Shakespeare perhaps began *Timon* as a fit vehicle for poetic satire. He poured out his soul in Timon's soliloquies and the scenes in which Timon appeared; he carelessly composed some scenes and sketched others; then he threw it aside, and his fellow-actors got some hack-writer to fill up the gaps. It is possible that Shakespeare did not find the story of Timon suitable material for a tragedy; though the opening scene (which is not unlike the opening of *Le Bourgeois Gentilhomme*) suggests that all along the play was intended to be a social satire rather than a tragedy.

Pericles (1608) is the overture to the series of four romances with which Shakespeare ended his career as dramatist. The motto for these plays might be taken from the song in *As You Like It*:

> Then is there mirth in heaven,
> When earthly things made even
> Atone together.

In these plays Shakespeare harked back to the reunion of parted kinsfolk, a subject he had dealt with in the serious underplot of *The Comedy of Errors*. The first two acts of *Pericles* are terrible, and are the work of some very inferior playwright, possibly George Wilkins. In the third act there is a great and strong wind, and after it a still small voice which is undoubtedly the voice of Shakespeare. It is possible that Wilkins submitted two acts and a scenario to the Globe Theatre, and that Shakespeare finished the play, as the story harmonized with his mood at the time.

The Winter's Tale (1610) is in some of its scenes a sublimation of the pastoral-play. In this play the ' upstart crow ' borrowed a pair of wings from Greene, for it is based upon Greene's novel *Pandosto* (named *Dorastus and Fawnia* in its later editions). Autolycus is Shakespeare's own invention, and one of the most agreeable of all rogues. In the story of the wooing of Florizel and Perdita, the shepherdess *who is really a princess, Shakespeare dealt with a situation common in Menander and the New Comedy, but treated it in his own pure and delicate way.*

Cymbeline (1610) has been extolled as one of the greatest of all the plays, and has also been called the loosest and most disorderly play of Shakespeare. One critic has said that when Shakespeare wrote it he was careless of details in art, and another (with a taste for mathematics) has said that in the last act twenty-four distinct threads are caught up, and every one is accounted for. The play is somewhat complicated and difficult to follow, but it contains the beautiful figure of Imogen, the sweetest woman ever created by God or man. This character and some magnificent poetry help to make amends for a certain lack of probability in this play, which treads close on the heels of the greatest of the plays.

The Tempest (1611) is the greatest of the four romances, and is Shakespeare's swan-song. It has been thought that this play was written for some special occasion, which may have been the marriage of Princess Elizabeth to the Prince Palatine Elector. The play begins with a scene which must have demanded most elaborate stage devices—something in the nature of a 'set-piece'. Music and magic and poetry meet in *The Tempest* and make it the Master's masterpiece. Its technique is perfect. It obeys the laws of unity of time and of unity of place. It has solved the problem of how to represent a reconciliation—twelve years having elapsed since the estrangement—upon the stage. It is impossible to refrain from identifying Prospero with Shakespeare himself. Prospero the magician is a man who has complete mastery over himself. His magic chiefly consists in this.

Henry VIII (1612) is actually the last play to which Shakespeare contributed a share, though *The Tempest* is his last great work and contains his farewell to the stage. *Henry VIII* is a pageant play " with three and a half catastrophes, varied by a marriage and a coronation ". Out of its seventeen scenes six only are the work of Shakespeare, the rest are by Fletcher. There is much versified Holinshed in this play. *Henry VIII*, like *Iolanthe*, represented the " Knights of the Order, with their Georges and Garters, the guards with their embroidered coats and the like "; and was in the opinion of a contemporary critic, Sir Henry Wotton, " sufficient in truth within a while to make greatness very familiar, if not ridiculous ".

Many plays in which he had little or no share have been attributed to Shakespeare either in pure ignorance or owing to the greed of publishers. Some of these plays have been defended as Shakespearean by critics who preferred paradox to truth. It will be sufficient here to name the plays which have been attributed to Shakespeare, but in which he had, according to competent authority, no share. They are: *Fair Emm*, *Sir Thomas More*, *George-a-Green*, *The Merry Devil of Edmonton*, *Mucedorus*, *The Birth of Merlin*, *'Larum for London*, *Warning for Fair Women*, *The London Prodigal*, *Thomas Lord Cromwell*, *Sir John Oldcastle*, *The Puritan Widow*, and *Locrine*. There are four plays which have been claimed by distinguished critics as in part the work of Shakespeare: *The Two Noble Kinsmen*, possibly the work of Fletcher and Massinger; *Edward III*, where the Countess of Salisbury scenes are singled out as Shakespearean; *Arden of Feversham*, published in 1592, and obviously the work of a mature writer, which Shakespeare was not at that date; and *A Yorkshire Tragedy*, a sordid play not in Shakespeare's later style, describing an event which happened in 1605.

Appreciation

To attempt in a few words to appreciate the genius of Shakespeare is as difficult as it is to " hold infinity in the palm of your hand ". Nevertheless, certain salient features of the man may be briefly set down. Shakespeare was a perfect man; compared with him almost all other men appear like children, tossed to and fro, and carried about with every wind of doctrine. The greatest of all his manifold gifts was his large-minded impartiality—his god-like tolerance, which enabled him to sympathize with human nature in all its shapes, degrees, depressions, and elevations. Another of his great gifts was that he had, especially in his mature plays, the happy knack of pleasing both himself and his audience with his work. He did not, like Fletcher, pander to the groundlings; nor did he, like Jonson, attempt to bully them into liking what was above their heads. The audience asked for an entertainment of one kind or another; Shakespeare always gave it something better than what it demanded. When asked for stones he gave bread; or rather, Deucalion-like, he threw the stones over his head and gave life to them. Simply by the alchemy of his genius he could turn the base lead of crude farces, tedious chronicle-histories, and ranting tragedies of revenge into the pure gold of his sunny comedies, his masterly historical plays, and his majestic tragedies. He was born at a fortunate time. Marlowe, one of the greatest of literary pioneers, had made straight the paths for him, especially by showing him the capabilities of blank verse. He began by writing in a tentative fashion; when he had completed his great series of historical plays, he was a past-master of dramatic writing. The composition of his histories purged his mind of a certain amount of youthful frothiness, and was probably the best education that he could have had. He then went on from strength to strength, writing masterpieces of romantic comedy and tragedies of all kinds, ending finally with his romances, in which he seems to look down as from a height upon all the doings of mankind. His mental life was one of continual strain and stress, but in the end he attained complete serenity of soul, and found himself in the haven where he would be.

He was not always a perfect artist; men of his type do not attain to that perfection which is almost a monopoly of the Greeks. Jonson, one of his earliest critics, said that " he flowed with that facility that sometime it was necessary he should be stopped ". Some of his plays, notably *Measure for Measure* and *All's Well,* ran away with him. But it is unwise to say again what has been said once and for all by Dryden, in what is perhaps the manliest piece of Shakespearean criticism ever written:

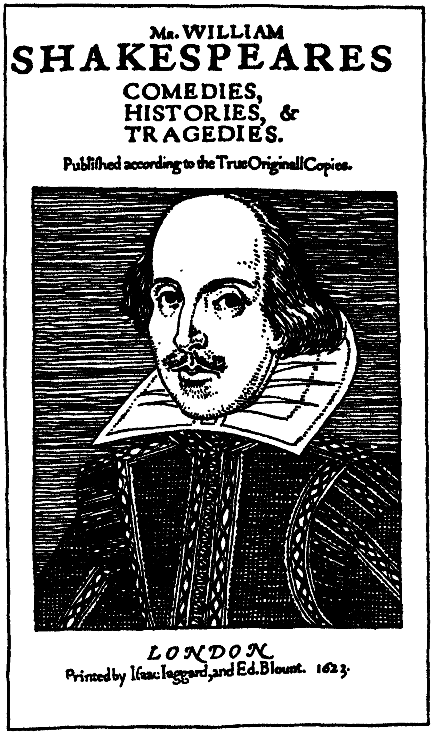
> To begin, then, with Shakespeare. He was the man who, of all modern and perhaps ancient poets, had the largest and most comprehensive soul. All the images of nature were still present to him, and he drew them not laboriously but luckily; when he describes anything, you more than see it, you feel it too. Those who accuse him to have wanted learning, give him the greater commendation. He was naturally learned; he needed not the spectacles of books to read nature; he looked inwards and found her there. I cannot say he is everywhere alike; were he so, I should do him injury to compare him with the greatest of mankind. He is many times flat, insipid; his comic wit degenerating into clenches, his serious swelling into bombast. But he is always great when some great occasion is presented to him; no man can say he ever had a fit subject for his wit, and did not then raise himself as high above the rest of poets,
>
> Quantum lenta solent inter viburna cupressi.

This passage gives a succinct account of Shakespeare as an artist. As a man, the most striking feature about him is his prosperity. With boundless possessions in the realms of imagination, with a hunting-lodge in the forest of Arden, and a seaside house in Bohemia, he still set a value upon 107 acres of land near Stratford. He did not despise worldly and material success, in this respect resembling Chaucer, Scott, and Gilbert.

If we seek to measure Shakespeare, we have no standard by which to do so, so far does he out-top other great writers. The titanic mirth of Aristophanes, the sublimity of Æschylus, the perfection of Sophocles, the humanity of Euripides, the Pantagruelism of Rabelais, the humour of Cervantes, the sparkle of Molière, the toleration of Fielding—all these qualities we find in abundance in the works of Shakespeare; and, as well, we find a subtle essence of fire and air permeating all the great plays—an essence which we can describe by one epithet only, the epithet ' Shakespearean '.

Early Editions of Shakespeare

Seventeen of Shakespeare's plays (including *Pericles*) were printed in quarto between 1597 and 1622. Four of the plays published in quarto are obviously pirated (*Romeo and Juliet, Henry V, Merry Wives,* and *Hamlet*), and it is not likely that Shakespeare authorized, though he may have connived at, the publication of any of them. In 1623 appeared the first collected edition of Shakespeare's plays, usually known as the First Folio. It was set forth by John Heminge and Henry Condell, Shakespeare's fellow-actors. It contains thirty-six plays (all the canonical plays except *Pericles*), twenty of which appeared in print for the first time. Over one hundred and eighty copies of the First Folio survive, but only fourteen are in a quite perfect state. The Second Folio (1632) is a reprint of the First, and makes a few alterations, many of which are for the worse. The Third Folio (1663 and 1664) is mainly a reprint of the Second; the 1664 impression contains *Pericles* and six pseudo-Shakespearean plays. The Fourth Folio (1685) is a reprint of the 1664 impression of the Third.



Mr. WILLIAM
SHAKESPEARES
COMEDIES,
HISTORIES, &
TRAGEDIES.
Publiſhed according to the True Originall Copies.

LONDON
Printed by Iſaac Iaggard, and Ed. Blount. 1623.

The Title-page of the First Folio (1623)

Other Editions, Critical Works, &c.

Dryden, though he joined with Davenant to treat *The Tempest* as Chiron and Demetrius treated Lavinia, was one of the best as he was one of the earliest Shakespearean critics. The first critical editor was the Poet Laureate Nicholas Rowe, who in his edition of 1709 corrected some of the most palpable errors, and gathered together some facts and legends about Shakespeare's life. Pope in his edition of 1725 made some happy emendations, but was an injudicious though well-meaning editor. Theobald (1733) was a scholarly and ingenious editor, and made many brilliant emendations, of which one (a' babbled of green fields) is probably the best emendation in ancient or modern literature. Hanmer (1744), a learned country gentleman, did not contribute much to Shakespearean scholarship; nor did Warburton, who reissued Pope's edition with many notes of his own in 1747. Dr. Johnson's edition (1765) is chiefly famous for its preface, an embodiment of sound common-sense. Capell's edition (1768) is the work of a thorough but not superficially attractive scholar. Steevens, who reissued Johnson's edition in 1773, was able but rash and irreverent. Malone, his rival, was laborious but more honest. His edition appeared in 1790. Variorum editions embodying the work of Johnson, Steevens, and Malone appeared under the editorship of Reed in 1803 and 1813, and under the editorship of James Boswell (the younger) in 1821. The Shakespearean forgeries of W. H. Ireland, of no importance in themselves, are interesting as having deceived for a time the very elect. In the early part of the nineteenth century a new era in Shakespearean criticism was opened up by Coleridge, Schlegel, Hazlitt, and Lamb. Coleridge especially, though he lectured with as little method as Tristram Shandy had in writing his *Life and Opinions*, was in many ways the greatest of Shakespearean critics. His tradition was carried on at a later date by Swinburne, who is an excellent critic, though sometimes most emphatic where his case is weakest. The editions of Singer, Collier, Knight, Halliwell, Dyce, and Staunton all contribute something to our knowledge of Shakespeare. The Cambridge edition of Clark and Wright (1863–6) is chiefly remarkable for its extensive critical apparatus, which enshrines many worthless 'emendations' made by unskilled labourers in criticism. Delius's edition (1854–61) presents a text formed upon sound critical principles. A new Variorum edition was undertaken by H. Howard Furness of Philadelphia, who edited fifteen plays between 1871 and his death in 1912; his son has carried on his father's plan and edited three plays. Each volume of this edition is a library in itself. Other editions are too numerous to mention, but the following may be singled out as important: Dowden, Craig, and Case, *The Arden Shakespeare* (1899–1918); Sir Sidney Lee, *The Renaissance Shakespeare* (1907–10, reissued as *The Caxton Shakespeare*, 1910); and Sir Arthur Quiller-Couch and J. D. Wilson, *The New Shakespeare* (begun in 1921).

It would be impossible to give even an indication of the number of books that have been written about Shakespeare. Should they continue to increase at their present rate, it is likely "that even the world itself could not contain the books that should be written". There is no doubt that many of these books serve no useful purpose. Not a few of them are autobiographies, or political or religious pamphlets in disguise. Many of the German and American books on Shakespeare are theses for the doctorate, of the highest educational value to those who wrote or compiled them, but of no interest or importance to anyone else. Many other books are mainly or entirely devoted to confuting previous absurd criticisms. Some writers subject Shakespeare to a curious process of indexing, as if he had written an Encyclopedia; others again cut him into small pieces, which they bind for a sign upon their hands and as frontlets between their eyes. But although there has been much lost labour, some good books and a few extremely good books have appeared in recent years. A few of these will be named in the Bibliography.

Two tendencies of modern scholarship must be mentioned. One is a tendency to adhere whenever possible to the text of the First Folio. The early editors emended what they failed to understand, which is another way of saying they emended freely. Modern scholarship emends sparingly and cautiously. The other tendency is to set a high valuation upon the punctuation of the First Folio, which is supposed to be elocutionary rather than syntactical. Dr. Johnson, 'rich in saving common-sense', criticized this theory some one hundred and fifty years in advance of its formulation by asking: "What could be their care of colons and commas who corrupted words and sentences?"

Foreign contributions to Shakespearean scholarship are numerous, and many of them are valuable. There is no space to enumerate any of them, but no article on Shakespeare would be complete without a mention of the great French translation by François Victor-Hugo, and the great German translation of Tieck and Schlegel. No higher praise can be given to these two translations than to say that they are not unworthy of the original.

In a felicitous passage Swinburne has compared students of Shakespeare to them that go down to the sea in ships, and occupy their business in great waters. "For two hundred years at least have students of every kind put forth in every sort of boat on a longer or a shorter voyage of research across the waters of that unsounded sea. From the paltriest fishing-craft to such majestic galleys as were steered by Coleridge and by Goethe each division of the fleet has done or has essayed its turn of work; some busied in dredging alongshore, some taking surveys of this or that gulf or headland, some putting forth through shine and shadow into the darkness of the great deep." Yet even those who have failed most signally in their quest have loved Shakespeare, not wisely but too well; and each of them might send to the ' adventurer in setting forth ' a message in the words of Theodorides:

Ναυηγοῦ τάφος εἰμί· σὺ δὲ πλέε· καὶ γὰρ ὅθ' ἡμεῖς
ὠλόμεθ', αἱ λοιπαὶ νῆες ἐποντοπόρουν.

A shipwrecked sailor, buried on this coast,
Bids you set sail.
Full many a gallant ship, when we were lost,
Weathered the gale.

The Baconian Heresy

The discovery that Francis Bacon wrote the plays of Shakespeare was more or less a sequel to Columbus's discovery of America. The originators and most of the exponents of the so-called Baconian theory have been Americans. J. C. Hart, the United States Consul at Santa Cruz, in his *Romance of Yachting* (1848), first raised doubts of Shakespeare's authorship of the plays. Miss Delia Bacon, who became permanently deranged in 1859, was the first to spread abroad a spirit of scepticism about Shakespeare's career, by means of a book published in 1856. W. H. Smith of London first suggested the Baconian authorship (1856). Nathaniel Holmes, Mrs. Henry Pott, and at a later date Edwin Reed took up the wondrous tale in America. The Baconian masterpiece, however, is *The Great Cryptogram* (1887) by Ignatius Donnelly, whom Swinburne unkindly called " Athanasius Dogberry, of New Gotham, U.S.A.". Mrs. Gallup (1900) also investigated a so-called cipher. Sir Edwin Durning-Lawrence, a Londoner, issued a preposterous and pretentious work entitled *Bacon is Shakespeare* in 1910.

Several writers who deny the Shakespearean do not affirm the Baconian authorship of the plays. Their names, some of which are fairly well known in legal and political circles, need not be recorded here. One of the latest recruits to their ranks is someone writing under the name of Looney.

These various heretical theories have no shadow of a shade of truth in them. None of them has ever explained away the unmistakable contemporary evidence that Shakespeare wrote his own plays—such evidence as that of Meres, Barnfield, and John Davies of Hereford, and, above all, that of Ben Jonson. Excepting only the fourth book of *Gulliver's Travels*, there is no stronger satire upon the human race than the fact that men have been found willing to support the Baconian theory.

Bibliography

It is wise to place at the head of a brief Shakespearean bibliography a *caveat* by one of the most sensible of Shakespearean critics, Dr. Johnson. " Notes are often necessary, but they are necessary evils. Let him that is yet unacquainted with the powers of Shakespeare, and who desires to feel the highest pleasure that the drama can give, read every play, from the first scene to the last, with utter negligence of all his commentators. ... Let him read on through brightness and obscurity, through integrity and corruption; let him preserve his comprehension of the dialogue and his interest in the fable. And when the pleasures of novelty have ceased, let him attempt exactness, and read the commentators." It has been aptly said that Shakespeare's work is fine gold, while that of his commentators is mainly German silver.

Books on Shakespeare may be divided into three classes:

(1) Those useful to ordinary readers.
(2) Those useful to students.
(3) Those useful to no one.

The subjoined list contains some of the first class (distinguished by an asterisk), and a few of the second.

Sir Sidney Lee, **A Life of William Shakespeare* (the standard biography); J. O. Halliwell-Phillips, *Outlines of the Life of Shakespeare*; F. G. Fleay, *A Chronicle History of the Life and Works of Shakespeare*; F. J. Furnivall and J. Munro, **Shakespeare: Life and Work*; Dr. Johnson, **Essays and Notes on Shakespeare* (edited by Sir W. Raleigh); S. T. Coleridge, **Notes and Lectures on Shakespeare*; W. Hazlitt, **Characters of Shakespeare's Plays*; E. Dowden, **Shakspere: a Critical Study of his Mind and Art*; **A Shakspere Primer*; **Introduction to Shakespeare*; Sir Walter Raleigh, **Shakespeare* (English Men of Letters Series); A. C. Bradley, **Shakespearean Tragedy*; *Oxford Lectures on Poetry*; A. C. Swinburne, **A Study of Shakespeare*; J. Churton Collins, *Studies in Shakespeare*; B. Wendell, *William Shakespeare: a Study in Elizabethan Literature*; G. Brandes, *William Shakespeare*; Morton Luce, **A Handbook to the Works of William Shakespeare*; G. P. Baker, *The Development of Shakespeare as a Dramatist*; D. H. Madden, **The Diary of Master William Silence*; Sir A. T. Quiller-Couch, **Shakespeare's Workmanship*; various contributors, *Shake-*

speare's England (a tercentenary tribute, 1916); J. Bartlett, *Concordance to Shakespeare;* R. J. Cunliffe, *A New Shakespearean Dictionary;* M. Edwardes, **A Pocket Lexicon and Concordance to the Temple Shakespeare;* E. A. Abbott, *A Shakespearian Grammar.*

Shale, a term applied in geology to argillaceous strata which possess to a greater or less degree the quality of splitting into layers parallel to the planes of deposition. It is the solidified mud of ancient waters, sandy, calcareous, purely argillaceous, or carbonaceous. Shale frequently contains fossils in a good state of preservation, such as the leaves of plants associated with the coal-measures. The variety known as bituminous shale or oil-shale burns with flame, and yields paraffin (q.v.). Alum is also largely manufactured from shales which contain decaying iron pyrites.

Shalloon′, a light woollen or worsted stuff said to derive its name from *Châlons* (Châlons-sur-Marne, France). An extended meaning is now attached to the name, for it is used to indicate a weave (the 2 up, 2 down twill), while fabrics or bags made from vegetable fibres and used in the European War were denoted by the same name.

Shallot′, a plant, the *Allium ascalonicum*, a species of onion, the mildest cultivated. It is sufficiently hardy to endure the severest winters of England.

Sha′manism, the religious system of the Shamans, sorcerers, magicians, and necromancers, a form of savage magic prevailing among the peoples of Central and Western Asia and the Turanian peoples of Siberia, as well as among American Indians. It is based upon the belief that the world is pervaded by spiritual forces, and that the Shaman has the power to control nature and to drive away or propitiate the spirits.

Shamrock, the name commonly given to the national emblem of Ireland, said to have been adopted by St. Patrick as an illustration of the Trinity in Unity. It is a trefoil plant, generally supposed to be the plant called white clover (*Trifolium repens*), but some think it to be rather the wood-sorrel (*Oxălis acetosella*). The plant sold as shamrock is commonly yellow trefoil (*Trifolium minus*).

Shanghai, a city and seaport of China, in the province of Kiang-su, on the Hwang-pu River, about 12 miles above its entrance into the estuary of the Yang-tse-kiang. The walls of the Chinese city proper are about 3 miles in circumference, and enclose a dismal group of hovels and crooked, insanitary streets. In 1843 Shanghai was opened as one of the five treaty ports, and an important foreign settlement is established with extra-territorial rights. Along the bank of the river, in front of the British, American, and French settlements, extends a wide *bund*. In the foreign settlement there are a fine cathedral, municipal offices, hospitals, club-house, &c. The citizens of each nationality are under the protection of their respective consuls, and there are courts for each nationality. The Chinese Imperial Maritime Customs (under British officials) control the customs duties. Shanghai has railway and water communication with a third of China, and its trade is very extensive. The chief imports are cottons, cotton yarns, woollens, opium, petroleum, and sugar; and the exports, silk, tea, rice, cotton and cotton yarn, hides, and wool. The largest part of the foreign trade is in the hands of British merchants. The manufactures include cotton-spinning, silk-winding, &c. The European population is about 12,000, the Chinese, 1,538,500 (Chinese Post Office return).

Shannon, the largest river of Ireland, rises at the base of Cuilcagh Mountain in County Cavan; flows south-west and south through Loughs Allen, Boderg, Bofin, Ree, and Derg; divides Connaught from Leinster and Munster; and enters the Atlantic by a wide estuary, at the mouth of which are Loop Head in Clare and Kerry Head in Kerry; length, about 250 miles; drainage basin, about 4400 sq. miles. The chief affluents of the river proper are the Suck and Brosna.

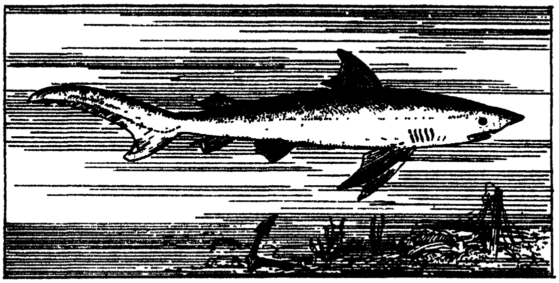
Shan-si′, an inland province of Northern China; area, 81,830 sq. miles. The chief grain crops are wheat and millet. T'ai-yuan is the capital. Shan-si is one of the most extraordinary coal (bituminous and anthracite) and iron regions of the world. Pop. about 10,000,000.

Shan States, a number of small semi-independent communities occupying a district on the eastern approaches of Upper Burmah. Each state is governed by a chief and a council; the nominal religion is Buddhism. The people (Shans) have attained much proficiency in various handicrafts, and show great aptitude for trade.

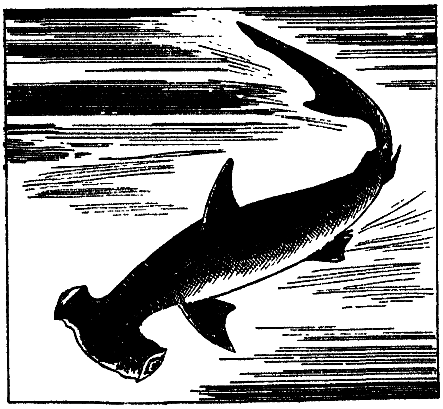
Shantung′, a maritime province of China, on the Yellow Sea; area, 55,970 sq. miles. The greater portion is level; the chief river is the Hoang-ho, which flows north-east into the Gulf of Pechili. Wheat, millet, and indigo are the chief products, and the manufactures include silk, hempen cloths, and felt. In this province both Mencius and Confucius were born. The capital is Tsi-nan-fuo. The province includes the port of Chifu and the territories of Kiao-chow (see *Tsingtao*) and Wei-hai-wei. Pop. about 26,000,000.

Shap′inshay, one of the Orkney Islands of Scotland, between the Islands of Stronsay and Pomona. It is about 4½ miles long and 4 miles broad. Pop. 620.

Shark, the general name for a group of elasmobranchiate fishes, celebrated for the size and voracity of many of the species. The form of the body is elongated, and the tail thick and fleshy. The mouth is large, usually ventral, and armed with several rows of compressed, sharp-edged, and sometimes serrated teeth. They are the most formidable and voracious of all fishes, pursue other marine animals, and seem to care little whether their prey be living or dead. They often follow vessels for the sake of picking up any offal which may be thrown overboard, and man himself often becomes a victim to their rapacity. The sharks formed the genus Squalus of Linnæus, which is now divided into fifteen families, including extinct forms. Rondelet's shark (*Carcharodon Rondeletii*) is one of the largest species, sometimes attaining the length of 40 feet. It is found in all the warmer seas. The famous blue shark (*Carcharias glaucus*) is one of the most formidable and voracious of the species. It is rare on the British coasts, but common in many of the warmer seas, reaching a length of over 30 feet. The hammer-headed sharks (Zygæna), which are chiefly found in tropical seas, are very voracious, and often attack man. They are noteworthy for the remarkable shape of their head, which resembles somewhat a double-headed hammer, the eyes being at the extremities. See *Ichthyology*; *Elasmobranchii*; *Dog-fish*; *Porbeagle*.



White Shark (*Carcharias lamia*)



Hammer-headed Shark

Sharp, James, Scottish ecclesiastic, born in 1618, died in 1679. He was recognized as a leader of the moderate party in the Church, on whose behalf he visited London as one of their deputies to Cromwell. He was afterwards actively in favour of the Restoration, and was rewarded by being appointed professor of theology in St. Andrews, and chaplain to the king for Scotland. In 1661, when the Parliament established Episcopacy, he was appointed Archbishop of St. Andrews. His persecutions of the Covenanters made him detested by that party, and in 1679 he was waylaid and murdered on Magus Moor, Fifeshire.

Shaw, George Bernard, British dramatist, novelist, and critic, was born in 1856. At the age of fifteen he began work in a land-agent's office at Dublin, but eventually removed to London (1876), where his novels *The Irrational Knot* (1880) and *Love Among the Artists* (1881) were published as serials. Between 1885 and 1898 Shaw was successively on the staff of *The Pall Mall Gazette*, art and musical critic of *The Star* (1890–4) and of *The World*, and dramatic critic of *The Saturday Review*. Among his works are the novels *Cashel Byron's Profession* (dramatized in 1903 as *The Admirable Bashville*), *An Unsocial Socialist*, and *Love among the Artists*; and the plays *Widowers' Houses* (his first play, produced 1892), *Mrs. Warren's Profession* (banned by the censor, but ultimately played in 1902), *Cæsar and Cleopatra* (1898), *Arms and the Man* (1894), *You Never can Tell* (1896), *Man and Superman* (1903), *Major Barbara* (1905), *The Doctor's Dilemma* (1906), *Fanny's First Play* (1911), *Pygmalion* (1912), *Back to Methuscleh* (cycle of five plays) (1921), and *Saint Joan of Arc* (1923). Shaw has adapted his plays to the needs of a novel-reading public by the introduction of lengthy stage directions and explanatory descriptions. He won the Nobel Prize for 1925.

Shawl (Pers. *shál*), an article of feminine attire for covering the shoulders, is either knitted or woven, and generally square or oblong in shape. The choicest shawls, both for fineness of material and beauty of design and colouring, are those made in Kashmir from the short under-wool of a Tibetan goat. Many of these are elaborately embroidered; in those plainly woven the ' cone ' ornament is prominent in the pattern. Some colonies of Kashmiri shawl-makers are settled in the Punjab, but their work is of inferior quality. The Scottish town of Paisley was long noted for its clever imitations of the

Kashmir shawls, the annual local output at one time amounting to the value of £1,000,000. Shawls, very popular in mid-Victorian days, are now but little worn; those chiefly used to-day are largely knitted in the Shetland Isles. These are light, warm, and beautifully made.

Shea, the *Bassia butyracea* of botanists, is a native of tropical Asia and Africa. The trunk of this tree, when pierced, yields a copious milky juice, and *shea* or vegetable butter is found in the nuts when crushed. See *Bassia.*

Shears, cutting instruments which act by shearing. The blades of the shears, or scissors, used for cutting cloth are set with great care to ensure cutting from point to rivet. In engineering, the name shears is given to a heavy tool used for cutting steel plates or girders. The work is held by overhanging cranes over a fixed blade, and a second blade is mechanically operated to cut down through the material.

Shear-tails (Thaumastura), a genus of humming-birds, of which the slender shear-tail (*T. enicura*) of Central America and Cora's shear-tail (*T. cora*) of Peru and the Andes valleys are two familiar species.

Shearwater, the name of several marine birds of the genus Puffinus. The great shearwater (*P. major*), which is 18 inches long, is found on the south-west coasts of England and Wales. They fly rapidly, skimming over the sea, from which they pick up small fishes, molluscs, &c. The name is sometimes applied to the scissor-bills or skimmers, species of Rhynchops.

Sheath-bills, or Kelp Pigeons (*Chiŏnis alba* and *C. minor*), birds belonging to the order Charadriiformes. A horny sheath overlies the nostrils, and is continued back until it extends in a kind of hood, thickly feathered, covering the face. In appearance and flight they are not unlike pigeons, their plumage being dazzlingly white. They inhabit the islands of the southern oceans.

Sheba, an ancient kingdom situated in Southern Arabia. The inhabitants of Sheba, or Sabæans, were celebrated for their wealth and prosperity. Their religion was the cult of nature, and their state was a feudal system. The Sheba of Arabia must not be confounded with the Sheba in Ethiopia, whose people were also called Sabæans (*Is.* xliii, 3). Whether the Queen of Sheba who came to visit King Solomon came from Arabia or from Ethiopia is doubtful.

Shechem. See *Nablus.*

Sheep, a ruminating mammal belonging to the family Ovidæ, which includes (1) true sheep (Ovis), (2) true goats (Capra), (3) the Bharal or blue sheep of Tibet (Pseudoïs), (4) Arui or Barbary sheep of North Africa (Ammotragus), and (5) the beardless goats (Hemitragus). True sheep are distinguished by the possession of face glands and interdigital glands, which are absent in the others. Both wild and domestic varieties exist, the former possessing a short tail, the latter a long one. Wild sheep have either curved or spiral horns, which may be absent or vestigial in domestic breeds. Although their origin is obscure, sheep have always played an important part amongst animals, and their importance to-day is reflected in the number (fully 24 millions) shown in statistics for the United Kingdom in 1921. From the agricultural standpoint they are important, for not only do they make use of mountain- and heath-land unsuited to tillage and to other classes of stock, but they also maintain the fertility of arable land. This is accomplished by folding sheep on specially grown crops, which are consumed by them with or without concentrated foods, when the consolidating effect of trampling, especially on light soils, and the value of the manure, are evinced in succeeding crops. In addition, the enlargement of their salivary glands allows of their existence on comparatively dry tracts of land, and their close grazing capacity gives them the advantage of the finest and sweetest portions of grass on even exposed bare land.

Variations in soil, climate, altitude, nature of herbage, systems of farming, and local fancies in respect of flesh, wool, and appearance naturally produce many breeds. These vary in size, nature of wool, general proportions and conformation of the body, rate of maturity, quality of flesh, prolificness, hardiness, adaptability, colour of face, and absence or presence of horns. However, the similarity of some breeds to others allows of their classification into three main groups:

1. MOUNTAIN BREEDS.—Blackfaces, Cheviot, Welsh Mountain, Radnor, Herdwick, Kerry Hill, Dartmoor, Exmoor, Clun Forest, Lonk, Shetland, Limestone, Derbyshire Gritstone, Roughfell, Swaledale, and Penistone.

Characteristics.—Smallest and hardiest breeds; can thrive on poor grazing; very adaptable; give good quality flesh; less prolific and usually slower maturing than others; wool is long and coarse, except in case of Cheviots and Welsh Mountain. Wool-clip, from 2½ to 6 lb. Dead-weight at 15 months, 45 to 70 lb. (Shetland excepted).

2. LONG-WOOLLED BREEDS.—Lincoln, Kent, Devon Long Wool, Leicester, South Devon, Wensleydale, Border Leicester, and Cotswold.

Characteristics.—Largest breeds; suit rich pasture; mature quickly; fairly prolific; give heavy fleeces of long, lustrous wool; carcass tends to bear too much fat. Wool-clip varies from 7 to 14 lb. Dead-weight at 15 months, 75 to 120 lb.

3. SHORT-WOOLLED BREEDS (DOWN BREEDS).—Hampshire, Shropshire, Oxford, Suffolk, South Down, Dorset Horned, Dorset Down, and Ryeland.

Characteristics.—Large size; suit down land and folding-on crops; prolific; quick maturing; large proportion of lean meat; most valuable wool; less hardy and adaptable than mountain breeds. Wool-clip, 5 to 8 lb. Dead-weight at 15 months, 75 to 100 lb.

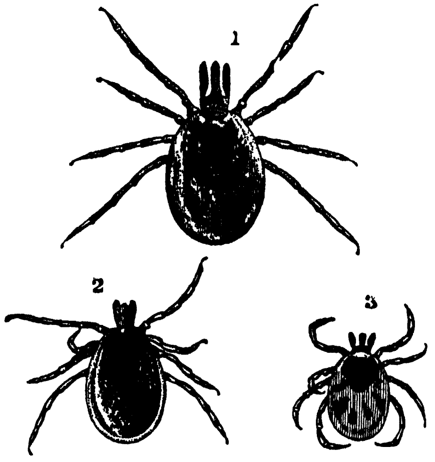
The period of gestation averages 150 days. One crop of lambs is produced per year, one lamb per ewe being desired from mountain breeds, and two from others. Ewes are usually kept for breeding for five years, whilst for mutton

purposes lambs and hogs are killed from the ages of twelve weeks to eighteen months.

Sheep-laurel, a small North American shrub of the genus Kalmia (*K. angustifolia*). It is a favourite garden shrub, but is poisonous to cattle.

Sheep's-head, the name of a fish (*Sargus ovis*) caught on the shores of Connecticut and Long Island. It is allied to the gilt-head and the bream, and is considered a delicious food.

Sheep-tick, a well-known dipterous insect (*Melophăgus ovīnus*) belonging to the family Hippoboscidæ or horse-flies. The pupæ produced from the eggs are shining oval bodies which become attached to the wool of the sheep. From these issue the tick, which is horny, bristly, of a rusty ochre-colour, and wingless. It fixes its head in the skin of the sheep, and extracts the blood, leaving a large round tumour.



Sheep-ticks

1 and 2, *Ixodes ricinus*, female and male (both × 8). 3, *Ixodes hexagonus*, female (× 4).

Sheerness, a naval base, dockyard, and garrison town of England, in the county of Kent, and in the Isle of Sheppey, on the River Medway, at its junction with the Thames; served by the South-Eastern & Chatham Railway. The fortifications, which are entirely modern, are of immense strength. The Admiralty dockyard employs a large number of men, and is principally utilized for repairs. Sheerness has large military and naval barrack accommodation. Pop. 18,600.

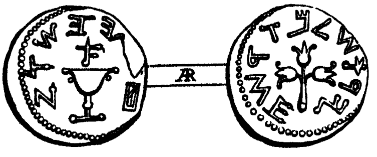
Sheffield, a city of Yorkshire, the fifth in size, and one of the chief industrial cities of England, stands at the junction of the Sheaf and Don; served by the Midland, Great Northern, and Great Central Railways. The site of the town was originally confined to the angle formed by the Sheaf and Don, but it now extends along the slopes above these rivers and their tributaries, the Loxley, Rivelin, and Porter. Buildings include the church of St. Peter's, the Cutlers' Hall (seat of the Cutlers' Company, incorporated in 1624), and the university (1905). The trade of Sheffield is chiefly connected with cutlery and the manufacture of all forms of steel, iron, and brass work, for which it has long been famous. The steel manufacture includes armour plating, rails, engine castings, and small-arms; engines, machinery, plated goods, Britannia-metal goods, optical instruments, stoves and grates, and many other hardware lines are produced.

Sheffield was granted a charter by Edward I (1296). In the time of Edward III it was known for its 'whittles', and acquired increasing skill in iron work and cutlery production through the settlement of Dutch artisans in Elizabethan times. Pop. (1921), 490,720.

Sheffield Plate, the forerunner of the modern electro-plate, produced by applying a coating of silver to a foundation of inferior metal by means of the galvanic current. In 1742 Thomas Bolsover, a Sheffield mechanic, was repairing a silver knife and 'cramping' the joint with a penny, when he over-heated the metals, which fused. Bolsover saw the possibilities which lay in his discovery, and succeeded in applying by fusion a thin coat of silver to a copper base. Though he produced many articles of 'Sheffield' plate, he failed to reap the full reward; but Joseph Hancock, his apprentice, later took up the work in earnest. By 1760 several firms were actively engaged in the new trade. The silver-plating was applied to the copper base in the proportion of about one part to twelve, adhesion being procured by fusion in a furnace. Further processes of the work included forge-hammering, or rolling; 'raising'; the addition of such 'members' as handles, teapot spouts, &c.; 'swaging', for producing bands and raised edges; chasing, piercing, embossing, fluting, &c. Two distinct 'periods' of Sheffield plate are generally recognized: the first, extending from the invention to about 1770, during which the foundation was of copper; the second, following a transition interval, when copper was replaced by German silver. This, being a white metal, did not show the signs of wear displayed by the dark copper base; but the quality of plate deteriorated from its introduction. Numerous specimens of Sheffield plate exist, and are much valued by collectors, particularly if of the first 'period'.—Cf. H. N. Veitch, *Sheffield Plate* (profusely illustrated).

Sheil (shēl), Richard Lalor, Irish politician and dramatist, born in 1791, died in 1851. He produced a number of plays and wrote a series of papers called *Sketches of the Irish Bar*. Along with O'Connell he agitated for Catholic emancipation, and in 1831 he entered Parliament as member for Louth. He was successively appointed Vice-President of the Board of Trade (1839), Judge Advocate-General (1841), Master of the Mint (1846), and minister at Florence (1850). Among his plays the best known are the tragedies *The Apostate* and *Evadne*.

Shek'el, a Jewish weight and in later times a coin. The weight is believed to have been about 218 or 220 grains troy, and the value of the silver coin 2*s.* 6*d.* sterling. A shekel (weight) of gold was worth £1, 16*s.* 6*d.* sterling. The shekel of the sanctuary is supposed to have been originally worth double the common shekel.



Half-shekel (silver) of Simon Maccabæus

Sheldrake, or **Sheildrake**, the name given to two species of British ducks, namely, the common sheldrake or bergander (*Tadorna cornuta*) and the ruddy sheldrake or brahminy duck (*Casarca rutila*). They are sometimes called burrow-ducks, from their habit of making their nests in rabbit-burrows.

Shell, the name applied to the external limy covering secreted by various groups of invertebrate animals, but restricted in a scientific sense to that form of exoskeleton secreted by the mantle of the mollusca. Thus the hard coverings of crabs, sea-urchins, lobsters, foraminifera, &c., are scientifically known as ' tests ', and are not to be regarded as true shells. The shell in mollusca grows with the growth of the animal, to which it affords protection. The shell or test of a crustacean does not grow after it has once been formed, but is cast and renewed from time to time. In its most elementary form the molluscan shell exists as simply a covering to the gills. In their chemical composition shells are usually composed of carbonate of lime, mixed with a small proportion of organic matter. See *Mollusca.*

Shelley, Mary Wollstonecraft, British author, the second wife of Percy Bysshe Shelley (q.v.), was born in 1797, died in 1851. Her romance of *Frankenstein* was published in 1818, when she was twenty-one years old. Her other works include *Valperga* and *The Last Man.* In 1840 she edited Shelley's works, with preface and biographical notes.

Shelley, Percy Bysshe, English poet, was born on 4th Aug., 1792, and died on 8th July, 1822. He came of an old family of Sussex squires, who were, however, Whigs in their politics, so that he grew up " with an addiction to liberty in the abstract, and with no special aversion to the revolution ". Shelley's father, Timothy, persuaded his father, Bysshe, to accept a baronetcy from the Whig Government during its short tenure of office in 1806, when the poet was in his fourteenth year. Shelley went to Sion House School, Brentford, at the age of ten, and to Eton just before his twelfth birthday. He went into residence at University College, Oxford, in Oct., 1810. Both at school and at college he showed himself a rebel at heart, and displayed an implacable enmity towards two fundamental institutions, fagging at Eton, and College Chapel at Oxford. He had developed atheistic or rather pantheistic views, and, being unfortunately imbued with a missionary spirit, he published a small pamphlet entitled *The Necessity of Atheism* in Feb., 1811, and indiscreetly sent copies to some bishops and heads of houses. For this, or rather for refusing to answer questions concerning the authorship of the pamphlet, Shelley was expelled from the university, together with his friend Thomas Jefferson Hogg. He then went to London and lived in lodgings; his loneliness was somewhat alleviated by the society of Harriet Westbrook, the daughter of a well-to-do retired hotel-keeper and a school friend of Shelley's sisters. Miss Westbrook, who was barely sixteen, nursed the delusion that she was persecuted at home, and threw herself upon Shelley's protection. He eloped with her to Edinburgh, and married her there on 28th Aug., 1811, though he did not approve of marriage as an institution. It is not necessary to go into the details of Shelley's unhappy domestic life. The exact facts of the case are not and probably never will be known, and even if they were they would make no difference to Shelley's poetry, which is, after all, the important part of his life. The story is a complex one. Respect for the marriage-laws makes biography, if less exciting, much easier to write. Suffice it to say that after two years of a wandering but not altogether unhappy life, the couple lost whatever affection they ever had for one another, and in July, 1814, Shelley fled to the Continent with Mary Godwin, daughter of William Godwin (q.v.) and his wife Mary (q.v.). Shelley remained on good terms with Harriet, settled £200 a year on her, and even invited her to rejoin his household, but she became more and more miserable and finally disappeared. Her body, in an advanced stage of pregnancy, was found in the Serpentine on 10th Dec., 1816. This was a great blow to Shelley, who, however, married Mary three weeks later. The last of the domestic misfortunes arising from his first marriage was that he was deprived (in March, 1817) of the custody of his two children by Harriet.

Shelley's earliest work did not give much promise of his genius. While very young he published two crude romances in the manner of 'Monk' Lewis, *Zastrozzi*, and *St. Irvyne, or the Rosicrucian*. The pamphlets which he contributed to the cause of Ireland were not above the standard of compositions of that kind. His first poem of importance, *Queen Mab*, was privately printed in 1813. It is full of promise, but aggressive and intolerant in its religious and political views. His prose dialogue *A Refutation of Deism* appeared in 1814. In the autumn of 1815 he wrote his first great poem, *Alastor, or the Spirit of Solitude*. After his marriage with Mary Godwin he settled at Great Marlow, in Buckinghamshire, where he wrote his long narrative poem, originally known as *Laon and Cythna*, but rechristened *The Revolt of Islam* after bowdlerization. Early in 1818 it was feared that Shelley was going into consumption, and he left England for Italy, where he was destined to spend the remaining four years of his life. Life in Italy amid the most beautiful scenery improved the quality and increased the quantity of Shelley's work. His friendship with Thomas Love Peacock (q.v.) had made him an ardent classical scholar, and his study of Greek was immensely beneficial to his mind, increasing its strength and decreasing its aggressiveness. He completed his *Rosalind and Helen* in 1818, and in the same year wrote *Julian and Maddalo*, which was inspired by his friendship with Byron. In 1819 he produced his two great works, *Prometheus Unbound*, one of the greatest lyrical dramas in the world, next to those of Æschylus, and his fine tragedy *The Cenci*. This tragedy is perhaps the greatest non-Elizabethan tragedy in English, though in its dark story it resembles the lost *Æolus* of Euripides, and the best-known of Ford's plays. Strange as it may seem, Shelley intended this play for the stage, and when drawing Beatrice Cenci had in mind the celebrated actress Eliza O'Neill. Shelley's satirical writings were not so successful: *The Masque of Anarchy* was inspired by the Peterloo massacre; *Peter Bell the Third* was a skit on Wordsworth almost as dreary as its archetype; and *Swellfoot the Tyrant*, a satire upon George IV and Queen Caroline, was an imitation of Aristophanes, and as little successful as such imitations always are. During this same period Shelley wrote many of his most beautiful lyrics, including the greatest of them all, the *Ode to the West Wind*. In 1820 he wrote his *Letter to Maria Gisborne*, and *The Witch of Atlas*, a fantastic but brilliant poem. His other longer poems include: *Epipsychidion*, inspired by a beautiful girl Emilia Viviani, who was confined in the convent of St. Anna; *Adonais*, a lament for the death of Keats; *Hellas*, a lyrical drama suggested by contemporary events in Greece; the unfinished historical drama *Charles I*; and the unfinished poem *The Triumph of Life*. Shelley was a highly accomplished translator, and his versions of the Homeric hymn *To Mercury* and of *The Cyclops* of Euripides are masterpieces. Among his prose works, *A Defence of Poetry* is a remarkable and original critical study. There is a certain amount of unsolved and probably insoluble mystery about how Shelley met his death. He was drowned, together with his friend Williams, while sailing from Leghorn to Spezzia, on 8th July, 1822. It is uncertain, however, whether the boat (the *Don Juan*) capsized in a sudden squall, or whether it was purposely run down by an Italian felucca intent upon robbery. Shelley's body was cast ashore ten days later near Viareggio. He had a volume of Keats in one pocket and a volume of Sophocles in the other. His body was cremated on 16th Aug. in the presence of Byron, Hunt, and Trelawny, and his ashes were buried in the Protestant cemetery at Rome.

In Shelley the spirit of lyric poetry was incarnate. His work is the quintessence of poetry, which is 'the breath and finer spirit of all knowledge'. His compeers are Sappho and Catullus. *To a Skylark*, *To Night*, and *The Cloud* are among the best-known of his lyrics, but there are many others as perfect if less popular. The greatness of his genius is hardly more remarkable than the mental growth he displayed in his later days. At first he was a stranger upon earth, and a petulant rebel, but he went from strength to strength in wisdom and in self-control. It was symbolic of his art that when his body was washed up his pockets contained the most perfect of Attic poets and the greatest of his own contemporaries. His poetry combines all the finest qualities of classical and of modern poetry. No other English poet could so truly say what Cleopatra said:

> I am fire and air; my other elements
> I give to baser life.

BIBLIOGRAPHY: E. Dowden, *Life of Shelley*; J. A. Symonds, *Shelley* (English Men of Letters Series); M. Arnold, *Essays in Criticism* (Second Series); T. J. Hogg, *Life of Shelley*; A. C. Bradley, *Oxford Lectures on Poetry*; E. J. Trelawny, *Recollections of the Last Days of Shelley and Byron*; Lady Shelley, *Shelley Memorials*; T. L. Peacock, *Memoirs of Shelley*.

Shells are the projectiles fired from artillery weapons. They are cylindrical in shape, fining down to a conical head, which, except in the case of armour-piercing shell, contains the fuse. Rotation is imparted to the shell by means of a driving band of soft metal, generally copper, secured to the shell. The driving band is cut into by the raised ribs or lands of the rifling, and so also provides a seal for the propellent gases, a stop to regulate ramming, and a support that prevents the shell from slipping back when the gun is elevated. The difference between all shells is one of degree, not of kind, and there are only three types: (1) the high-explosive type, in which the case breaks into missiles; (2) the shrapnel type, in which the missiles are contained in the case; and (3) the carrier type, in which the case contains chemicals of various kinds.

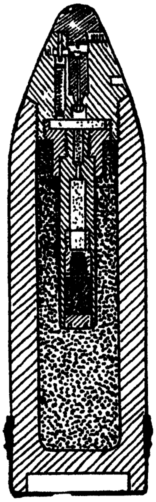


Fig. 1

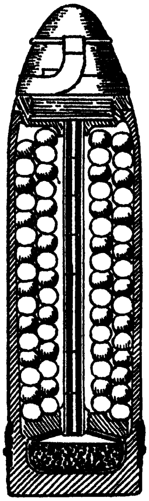


Fig. 2

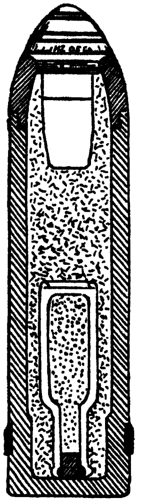


Fig. 3

Fig. 1.—18-pounder high-explosive shell in section, showing fuse screwed into nose of shell case. Case with thick steel walls, interior filled with high-explosive (lyddite, trotyl, or amatol). The fuse can be set to act in one of three ways, all based on percussion; (*a*) Instantaneously on impact to give good concussion effect; most used against troops in the open. (*b*) With 'delay' action to burst after penetration to a greater or less extent, giving good 'crater' effects; used against earthworks and buildings. (*c*) Again with delay action assisted by the effect of ricochet, causing a burst in the air, giving good splinter and concussion effect; useful against troops in trenches.

Fig. 2.—18-pounder shrapnel shell. Thin steel walls with central channel for passage of flame from fuse to bursting charge of black powder in base. Remainder of space filled with round bullets. Fuse screwed into nose of shell is 'set' to explode in the air close to the target, i.e. a 'time fuse'. Bursting charge merely blows off head of shell and releases bullets, which are thrown forward in a cone by force of original momentum. Normally used against personnel. Other varieties of this shell are 'star shell', which projects flares instead of bullets, and 'incendiary shells'.

Fig. 3.—Howitzer shell of carrier type. Thick steel walls; interior containing a sufficient bursting charge of high-explosive and a bottle filled with a chemical compound which on being exposed to the air becomes poison-gas of one form or another according to the nature of the contents of the bottle.

The *high-explosive type* consists of a steel case containing an explosive substance that will detonate, such as lyddite, trotyl, or amatol (British); melinite (French); picric acid (Italian); &c. The detonating wave passes from the fuse to a gaine or exploder, and thence to the main high-explosive filling. When fired with instantaneous-fuse, the shell bursts on top of the ground, and the body breaks into fragments, which fly outwards. The concussion effect is considerable, but the crater formed is small. It is used against troops and guns in the open or under light cover, for wire cutting, and for concussion effect against concrete or masonry works from which other shells ricochet. When fired with a 'non delay' or 'delay' fuse, allowing a small fraction of time to elapse between the shell hitting and its detonation, the shell is apt to bury itself, and the burst is consequently smothered. The splinter effect is reduced by the large number of splinters which bury themselves in the crater. The crater effect, on the other hand, is good, the depth of crater depending on the delay between hitting and detonation, velocity of the shell, &c. With a long 'delay' the shell may bury itself and burst underground, forming a subterranean crater with concussion effect. This kind of shell is used for the destruction of buildings, trenches, and strong cover other than concrete.

With high striking velocity, suitable ground, and small angles of impact a large proportion of high-explosive shell with 'delay' fuses will ricochet and burst in the air. The splinter effect laterally and downwards and the concussion effect are good; no crater is made. This ricochet effect is used against troops in trenches, prepared shell-holes and sunken roads, and against the personnel of shielded guns.

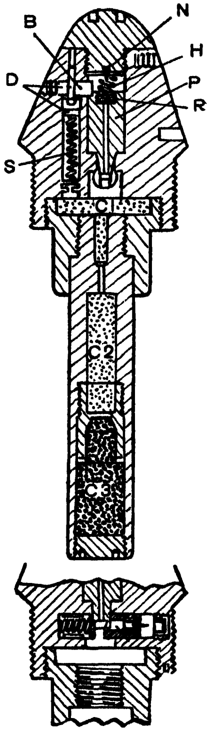


Fig. 4.—Fuse for use with high-explosive shell as in fig. 1. The shock of discharge causes the 'detent' D to compress the 'detent spring' S, and thereafter to be held in a new position, allowing the 'centrifugal bolt' B to move out of the way of the 'graze pellet' P. This 'graze pellet' is held away from the needle N only by the 'hair spring' H, so that the least jar is sufficient to force the 'primer' R in the end of the graze pellet on to the needle, by which it is exploded, the flame passing down through C1 and C2 to C3. Below, another type of fuse.

The *shrapnel type* includes shrapnel, incendiary, and star shell. A shrapnel shell, which is named after its inventor, Lieutenant-General Henry Shrapnel (1761–1842), consists of a steel case containing a number of bullets and a small bursting charge. The case is made as thin as possible to increase its carrying capacity, and, except for a central channel and the small bursting charge at the base, is completely filled with bullets packed in resin. The flash from the fuse passes down the central channel and ignites the bursting charge. This explodes, blowing off the head of the shell and forcing the bullets out of the case, which does not break up. Shrapnel, by means of a 'time-fuse', is generally made to burst in the air; the bullets, as they leave the case, opening out into a cone and covering a large area of ground. As the bullets rapidly lose their velocity, a shrapnel shell must be exploded close up to the target. Shrapnel, burst in the air, is used against troops in the open or under very light cover, or for creeping and protective barrages. Its forward effect makes it especially effective in enfilade. Incendiary shells are similar to shrapnel, except that the bullets are replaced by cylinders of an incendiary substance, such as thermit, which are ignited by the bursting charge and projected forward like shrapnel bullets. They are employed to set buildings, hayricks, &c., on fire, or burn crops or undergrowth. Star shells contain parachute flares, which are ignited and projected from the case by the bursting charge. The shell is burst in the air, and the flares sink slowly, lighting up the ground.

The *carrier type* includes gas shell, smoke shell, &c. The steel case contains a chemical composition, either liquid or solid, and a bursting charge. The bursting charge is only sufficient to break up the case, scatter the contents, and, if necessary, ignite them.

Shell-sand, sand mostly or largely composed of minute fragments of the shells of sea animals, common on many beaches. It is a valuable manure for soils requiring liming.

Shen-si, a northern province of China, bounded on the north by the Great Wall, and on the east by the Yellow River; area, 75,270 sq. miles. It is purely an agricultural province. Shen-si is a great channel of communication between China and Central Asia. Sian-fu is the capital. Pop. 6,700,000.

Shen'stone, William, English poet, born in 1714, died in 1763. He passed his life in retirement on his small paternal estate of Leasowes, beautifying it, and writing odes, elegies, ballads, and pastorals, which had considerable popularity. His *Schoolmistress*, in the Spenserian stanza, published in 1742, was the best-known of his poems; but he is chiefly remembered as a pioneer in the romantic movement.

Shepherd's Purse (*Capsella bursa pastōris*), a plant of the nat. ord. Cruciferæ. It is an annual weed, found in all temperate climates, having simple or cut leaves and small white flowers. In Britain it occurs in all situations up to 1200 feet.

Shep'pey, an island of England, in the county of Kent, at the mouth of the Thames, between the estuaries of the Medway and the Swale. It is 9 miles long and 5 miles broad, and contains the town of Sheerness. Pop. (rural district), 4592.

Shepton-Mallet, a town of England, in Somersetshire. It has a market-cross dating from 1500. Brewing is the principal industry, and there are roperies, &c. Asphalt-, marble-, and granite-works exist in the vicinity. Pop. 4300.

Sherardizing is a dry galvanizing process by means of which steel articles are coated with metallic zinc to act as a protection against rusting or corrosion. The process was invented by Sherard Cowper-Coles, and consists in packing the articles to be treated in zinc dust and heating to about 300° C. for some time. The zinc combines with the iron at its surface, and appears to form an alloy similar to that produced in ordinary galvanizing operations.

Sher'aton, Thomas, furniture designer, born at Stockton-on-Tees in 1751; removed to London about 1790; published several illustrated manuals of furniture design; died in London in poverty in 1806. He introduced a style of cabinet-making characterized by the strict subordination of ornamentation to utility, and generally by a severer taste than that of Chippendale, his predecessor. See *Furniture*.

Sher'borne, a town of England, in Dorsetshire. It is a place of great antiquity, having been the seat of a bishopric from 705 till 1078. The church of the ancient abbey, founded in 998, is one of the finest minsters in the south and west of England. There are also ruins of a castle, dating from the time of Stephen. The grammar-school (founded 1550) is a large and flourishing public school. Pop. 6400.

Sher'brooke, Robert Lowe, Viscount, British statesman, was born in 1811, died in 1892. He was educated at Winchester and at University College, Oxford. In 1842 he was called to the Bar, and the same year he emigrated to Australia, whence, after a successful career as barrister, journalist, and politician, he returned to England in 1851. He entered Parliament in 1852. As Vice-President of the Council from 1859 to 1864 he introduced the system of payment by the results of examination into school administration. His effective speeches against the Reform Bill of 1866 brought him into great prominence, and were largely responsible for the fall of the Russell-Gladstone ministry. He was Chancellor of the Exchequer under Gladstone from 1868 to 1873.

Sherbrooke, a city and port of entry of Quebec, Canada, at the confluence of the Magog and St. Francis Rivers; served by the Canadian Pacific, Grand Trunk, Boston & Maine, and Quebec Central Railways. It is the centre of an asbestos- and copper-mining, dairying, and mixed farming district, and has varied manufactures. Canada's Great Eastern Exhibition is held there annually (September). Pop. 22,100.

Sher'idan, Philip Henry, American soldier, born 1831, died 1888. He graduated at the Military Academy, West Point, in 1853, and from 1855 to 1861 served on the frontiers of Texas and Oregon. He greatly distinguished himself during the Civil War, and took a prominent part in the battle of Chickamauga. After the war he held various military commands. In Feb., 1884, on the retirement of Sherman, he succeeded to the command of the army.

Sheridan, Richard Brinsley Butler, Anglo-Irish dramatist and politician, was born on 30th Oct., 1751, and died on 7th July, 1816. His grandfather, Thomas Sheridan, was a friend of Swift; and his father, also named Thomas, was well known as an actor, as the author of *A Dissertation on Difficulties in Learning the English Tongue*, and as the holder of highly original views upon education. The dramatist's mother, who was a Miss Chamberlaine of Dublin, wrote several plays, one of which, *The Discovery*, was a stock piece at Drury Lane for many years. Richard Brinsley Sheridan therefore inherited an unusual amount of talent from both sides of the family, and he transmitted much of his ability to his descendants, many of whom were famous, the most celebrated being the first Marquess of Dufferin and Ava.

Sheridan was educated at Harrow School, where he remained from 1762 to 1768. He continued his education under a tutor, and was instructed in elocution by his father. In 1771 he collaborated with a school friend, N. B. Halhed, to translate the *Epistles* of Aristænetus (an anthology of love-letters), and to compose a farce originally entitled *Ixion*, but rechristened *Jupiter* after being recast by Sheridan. In March, 1772, he eloped to Calais with Miss Elizabeth Ann Linley, a beautiful girl of sixteen who had already made a name for herself as *prima donna* of her father's concerts. This was done to save Miss Linley from the persecutions of a married admirer, one Major Mathews, with whom Sheridan fought two duels, in the second of which he was seriously wounded. Sheridan and Miss Linley were secretly married in France, and were married again in England in April, 1773. This romantic episode not only provided Sheridan with a wife with whom he was ideally happy, but brought his name before the public, and was of undoubted value to him as an advertisement when he commenced dramatic author.

Sheridan's first comedy, *The Rivals*, was produced at Covent Garden Theatre on 17th Jan., 1775. It was not a success at first, owing partly to the fact that the part of Sir Lucius O'Trigger was taken by the actor John Lee, who belonged to a somewhat old-fashioned school of acting. It is probable also that the Faulkland and Julia interest was too prominent, and the play was revised and first performed in its revised version on 28th Jan., 1775, with Lawrence Clinch in the part of Sir Lucius. It became immensely popular, and at once took its place as a classic. It has been said that its characters are stock characters or caricatures or both; but its dialogue is brilliant and its plot is skilfully worked out. Mrs. Malaprop, in particular, though a distant relation of Dogberry, is a highly original creation, and has added one word and many phrases to the English language.

Sheridan's next play, a mere dramatic trifle entitled *St. Patrick's Day, or the Scheming Lieutenant*, was produced at Covent Garden on 2nd May, 1775. It was written for the benefit performance of Lawrence Clinch, who had been largely the means of saving *The Rivals*. It was intended to make money, and succeeded in this object. Sheridan then turned his attention to comic opera, and produced *The Duenna* at Covent Garden in Nov., 1775. The music was supplied by his father-in-law, Thomas Linley, and was in all probability mainly responsible for the success of the piece, which had a record run of seventy-five nights. There is not much wit in the opera, and it is fairly obvious that some of the lyrics are Sheridan's juvenile poems thus preserved from oblivion. Byron contrasted *The Duenna* very favourably with *The Beggar's Opera*; but the latter successfully demonstrated its vitality in 1920 and 1921.

In 1776 Sheridan bought Garrick's share in Drury Lane Theatre. He raised the money on mortgage, and only paid £1300 in cash. On 24th Feb., 1777, he produced *A Trip to Scarborough*, which is a *réchauffé* of Vanbrugh's *Relapse*. This play is usually printed among Sheridan's plays, but it has no more right there than *The Tempest* has in the works of Dryden and Davenant, though Sheridan's task was one of purification, not adulteration. Besides making Vanbrugh's play more respectable, however, Sheridan made several workmanlike improvements in it, and in particular bettered the first act by means of shortening it.

Sheridan's masterpiece, *The School for Scandal*, was produced at Drury Lane on 8th May, 1777. Although it has no appearance of being laboured, it cost its author much hard thought, and in despair he welded together two separate conceptions, *The Teazles* and *The Slanderers, a Pump Room Scene*. The construction of the play is not perfect, but the dialogue is so brilliant and the great scenes—especially the screen-scene—are so effective on the stage that they silence all adverse criticism. The play was almost suppressed by the Lord Chamberlain's office, but when it was produced it was acted by a company so brilliant that Genest, writing fifty years later, said: " No new performer has ever appeared in any one of the principal characters that was not inferior to the person who acted it originally ".

The last of Sheridan's great plays is *The Critic, or a Tragedy Rehearsed*, which was produced at Drury Lane on 29th Oct., 1779. It is a brilliant farce. It owes something to Beaumont and Fletcher's *Knight of the Burning Pestle* (1611), and to Fielding's *Tom Thumb the Great* (1730), and more to the Duke of Buckingham's *Rehearsal* (1672); but the very fact that it has caused these three burlesques to be almost forgotten is in itself a sufficient vindication of Sheridan's essential originality. As a critic said, to those familiar with *The Critic*: " Buckingham's farce now seemed rather like a blurred imitation of Sheridan than a representation of the original from which that great wit had drawn his idea ". There is a well-known story about how *The Critic* was completed. Two days before the first performance the third act was not written, so Linley and the actor King inveigled Sheridan into the small green-room on some pretext. There they incarcerated him, having provided him with pens and paper, two bottles of claret, and a plate of anchovy sandwiches, informing him that he would not be liberated until he had finished the play. Under such conditions were written some of the most brilliant scenes in English burlesque, including the famous 'discovery-scene' (the ἀναγνώρισις of Aristotle's *Poetics* !), the episode of Lord Burleigh's nod, and the entry of Tilburina and her confidante, mad, according to custom, the one in white satin and the other in white linen. Sir Fretful Plagiary was at once recognized as a caricature of the dramatist Richard Cumberland (q.v.), nor are there many better instances of a reputation ruined by ridicule than that of the author of *The West Indian*, who is now mainly remembered as having been Sheridan's model for this irritable dramatist. Mr. Puff is a splendid comic creation, and taken for all in all *The Critic* is one of the best burlesques written since Aristophanes produced *The Frogs*.

After an interval of almost twenty years Sheridan wrote *Pizarro*, which is described by its author as a tragedy, but which might more properly be called a patriotic melodrama. Sheridan would seem on internal evidence to have collaborated with Mr. Puff in the composition of this play, which is based upon Kotzebue's *Spaniards in Peru*. *Pizarro* adds nothing to Sheridan's reputation, but it added £15,000 to the treasury of Drury Lane in its first season.

Sheridan's career as a dramatist began when he was twenty-three, and for all practical purposes may be said to have ended when he was twenty-eight. He lived to the age of sixty-four, and gained a great reputation as a politician, a wit, and an orator, and a certain amount of notoriety as a spendthrift, and as the familiar friend of the Prince of Wales. The events of his life after the end of his literary career may be briefly recapitulated. He was returned to Parliament for Stafford as a supporter of Fox in 1780; he was Under-Secretary for Foreign Affairs in the Rockingham ministry in 1782, and Secretary to the Treasury in the Coalition ministry, 1783. He spoke for six hours on the charges brought against Warren Hastings with regard to the Begums of Oude (7th Feb., 1787). He opposed the Irish Union in 1799, was Treasurer of the Navy in the 'Ministry of all the Talents' in 1806 and 1807, and became a Privy Councillor. The close of his life was embittered by ill-health and debts. He lost his seat in Parliament and therewith his immunity from arrest for debt in 1812. He died in poverty, but not in the utter destitution described by some anecdotists. He certainly gambled heavily, especially after the death of his first wife, which took place in 1792. His second wife, whom he married in 1795, survived him.

Sheridan enjoyed an exaggerated reputation during his life-time and for some time after his death. Byron said of him: " Whatever Sheridan has done or chosen to do has been, *par excellence*, always the *best* of its kind. He has written the *best* comedy (*School for Scandal*); the *best* opera (*The Duenna*—in my mind far before that St. Giles's lampoon, *The Beggar's Opera*), the *best* farce (*The Critic*—it is only too good for an afterpiece), and the *best* address (*Monologue on Garrick*)—and to crown all, delivered the very *best* oration (the famous Begum speech) ever conceived or heard in this country." It was not uncommon to bracket together the names of Shakespeare and Sheridan (doubtless the alliteration encouraged this) as the two chief ornaments of the British stage. Then a reaction set in, and Sheridan was denounced as being himself a Fretful Plagiary, borrowing *this* from Molière, *that* from Fielding, and *the other thing* from the Restoration dramatists. The truth is that Sheridan was not a great creative genius, but he had admirable dramatic talent, he was a master of stagecraft, and above all he had a sparkling wit, and could write brilliant dialogue. Taking some of the stock characters and stock situations of comedy (some of them at least as old as Plautus), he suffused them all with his coruscating yet urbane wit, and may be said to have made them his own for ever. Perhaps the most serious charge which can be brought against Sheridan is that brought by Macaulay, who said that his dialogue was too brilliant, and that his very butts and dupes outshone the whole Hôtel de Rambouillet. To this Sheridan would probably have replied in the words of Mr. Puff: " Heaven forbid they should not in a free country! Sir, I am not for making slavish distinctions, and giving all the fine language to the upper sort of people."

BIBLIOGRAPHY: W. Fraser Rae, *Sheridan: a Biography*; Mrs. Oliphant, *Sheridan* (English Men of Letters Series); W. Earle, *Sheridan's Life and Times, by an Octogenarian*; Thomas Moore, *Life of Sheridan*; P. Fitzgerald, *Lives of the Sheridans*; Walter Sichel, *Sheridan, from new and original material.*

Sheriff, in England, the chief executive officer of the Crown in every county, appointed annually. The custody of the county is committed to him by letters-patent, and he has charge of all the business of the Crown therein. During his tenure of office he takes precedence within the county of any nobleman, and is entitled to sit on the bench with the justices of assize. The person appointed is bound under a penalty to serve the office, except in specified cases of exemption or disability, but a person who has served one year is not liable to serve again till after an interval of three years if there be another sufficient person in the county. The sheriff is specially entrusted with the execution of the laws and the preservation of the peace, and for this purpose he has at his disposal the whole civil force of the county—in old legal phraseology the *posse comitatus.* The most ordinary of his functions, such as the execution of writs, he universally performs by a deputy called under-sheriff, while he himself only performs in person those duties which are either purely honorary, such as attendance upon the judges on circuit, or which are of some dignity and public importance, such as presiding over elections and holding county meetings, which he may call at any time.

In Scotland there are three degrees of sheriffs, all of whom are appointed *ad vitam aut culpam.* The highest sheriff is the lord-lieutenant of the county; but as sheriff his office is merely nominal. The sheriff-depute, appointed by the Crown, is now known as *the* sheriff, or sheriff-principal, and is the chief judge of the county. Under him are one or more sheriffs-substitute, who are the resident judges ordinary of the county, and are also appointed by the Crown. The greater part of the duties of the office practically rests with the sheriffs-substitute, who have a rather wide jurisdiction in both civil and criminal cases. The sheriff-principal is usually an advocate practising in Edinburgh. There are also honorary sheriffs-substitute, who in minor cases may act for the sheriff-substitute in his absence. There is an appeal from the decisions of the sheriffs-substitute to the sheriff-principal, and from him to the Court of Session in most civil causes.

Sheriffmuir, or Sheriff Moor, a place in Scotland, in the parish of Dunblane, in Perthshire, where an indecisive battle was fought between the troops of George I under the Duke of Argyll, and a rebel force of Jacobites under the Earl of Mar, in 1715. See *Argyll, Campbells of.*

Sherman, William Tecumseh, American soldier, born in 1820, died in 1891. He passed through West Point and commanded an infantry regiment at the beginning of the Civil War, being present at Bull Run. After a period of service under Grant, Sherman became commander of the division of the Mississippi and invaded Georgia, receiving the capitulation of General J. E. Johnston at Durham Station in April, 1865. After a series of rapid promotions Sherman became commander-in-chief (March, 1869), and retired in 1884, his *Memoirs* being published in 1875.

Sherwood Forest, an ancient royal forest in Nottinghamshire, celebrated for the exploits of Robin Hood and his followers. The forest proper was the district between Nottingham and Worksop, extending about 25 miles north to south, and 6 to 8 miles east to west.

Shetland, an insular county of Scotland, north-east of Orkney; area, 551 sq. miles. It consists of about ninety islands and islets, of which twenty-seven are inhabited, the largest being the following: Mainland, Yell, Unst, Whalsay, Fetlar, and Bressay, the first occupying about two-thirds of the whole area of the group. The coasts are precipitous, and the deep creeks and sounds form noble natural harbours. The highest summit is Ronas Hill, in the north of Mainland (1475 feet altitude). The principal crops are black oats, bere, turnips, and potatoes. There is almost a total absence of trees. The live-stock, including cattle, horses, and sheep, were until recent years remarkable for their diminutive size, but these animals have been improved in size and value by crossing them with breeds from the south. The fisheries, especially the herring-fishery, are very valuable, and afford the chief employment. Lerwick (i.e. *Clay Bay*) is the seaport-capital; Scalloway is the ancient capital. Pop. 26,000.

Shetland Pony, one of the oldest established breeds, known from protohistoric times, an autochthon of the wind-swept, treeless wastes of the Shetland Islands. Its main features are smallness in size, prodigious capacity for work, amazing strength, and wonderful intelligence. The principal points are: (1) *Head*: small, fine, with large, intelligent eyes; wide, sensitive nostrils; full-flowing mane and forelock. (2) *Body*: compact, ribs well sprung, quarters strong, back short and straight, and shoulders deep and well sloped. (3) *Legs*: fore-legs short, strong, and muscular; well developed thighs in hind legs. (4) *Feet*: round, open, and of good blue horn. (5) *Tail*: full, abundant, and well carried. Symmetry, health, and vitality, suggested by appearance. (6) *Action*: true, close, and springy, the legs thrown well out from the shoulder and the hocks well fixed. The *Stud-book* height limit is 42 inches, but from 35 to 37 inches is more common.

Shiel, Loch, a fresh-water lake in Scotland, on the boundary between Inverness-shire and Argyllshire. It is about 15 miles long, but extremely narrow. It discharges by the River Shiel, which flows to the sea at Loch Moidart.

Shield-fern, a common name for ferns of the genus Aspidium, nat. ord. Polypodiaceæ, so named from the form of the indusium of the fructification, which is roundly-peltate. Two are natives of Britain, viz. *A. Lonchitis*, the holly fern, and *A. aculeatum*, the prickly shield-fern.

Shields, North, a seaport-town of England, in the county of Northumberland, on the Tyne, forming part of the county borough of Tynemouth, the whole of which is popularly called North Shields (Tynemouth forming the seaward portion).

Shields, South, a municipal and county borough of England, in the county of Durham, at the mouth of the Tyne, opposite to North Shields; served by the North Eastern Railway. The industries comprise ships and shipbuilding, manufactures of glass, earthenware, chain-cables, and anchors, and the shipping of coal. The ports of North Shields and South Shields are formed by an expansion of the river into a wide bay. Pop. 117,000.

Shi'ites, one of the two great divisions of Mahommedanism, the other being the Sunnites (q.v.). The Shi'ites believe the first three of the twelve Caliphs (Abu-Bekr, Omar, and Othman) to be impostors, and recognize only Ali (Ali Ben Abu Talib) and those descended from him by his marriage with Fatima, the daughter of Mahomet (Muhammad). The last of the Caliphs disappeared but will return, by the will of God, to lead his people. The stronghold of the Shi'ite sect, which is numerically inferior to the Sunnites, is Persia; in India Shi'ites form about 10 per cent of the Muslim population, but they predominate in Iraq, while some Syrians are Shi'ites, a few adherents have immigrated into Anatolia, and some are found in the former Russian Black Sea littoral. Dynasties founded by the sect include those of Tabaristan, the Idrisids of North-West Africa, the Fatimids of Egypt, and the Safavid, implanted in Persia. The Persian shah is the temporary representative of the Twelfth Caliph. The Shi'ites accept the *Koran* but not the *Sunna*, or body of customary tradition, for they possess their own traditions, and have added to the Confession (" There is no God but God, and Muḥammad is the Prophet of God ") the phrase, " Ali is Vice-regent of God ". Ali is considered second only to Mahomet (Muḥammad), and the tomb of Hassan, his son, at Kerbela (Iraq) is their chief sanctuary. Other holy places are Nejef (Najaf) and Kufa. The sultan of Turkey is not recognized by the Shi'ites as Caliph (Ar. *Khălifa*, successor, &c., i.e. a sort of Vicar of God upon Earth). See *Sunni*; *Persia*; *Mahommedanism*; *Caliph*; *Pan-Islamism.*

Shikarpur', the head-quarters of Sukkur district, Sind, Bombay, India; served by the North-Western Railway. It is an emporium for transit trade between the Bolan Pass and Karachi, but has lost much of its importance since the opening of the railway and its extension to Quetta. Manufactures include carpets and cotton cloth. Pop. 54,000.

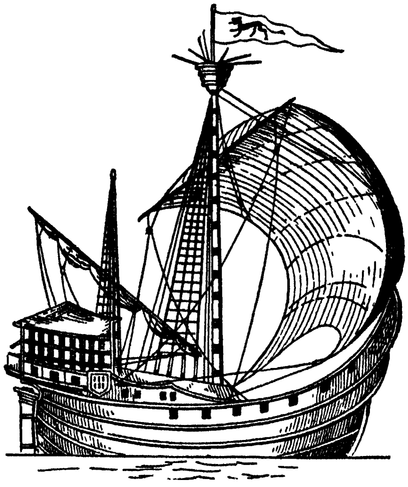
Shilling, a silver coin of Britain value 12 bronze pence. It has been minted since 1503 (Henry VII); the milled edge was introduced in 1662 (Charles II). The shilling was a money of account, however, long before the Norman Conquest, and had a different value in various parts of the country. The Old-English *scilling* bore a deeply engraved cross by means of which the coin could be separated into four quarters.

Shimo'ga, a district and town of Mysore, India. The town is the head-quarters of the district, and is the terminus of the Birur-Shimoga Railway. Area (district), 4025 sq. miles; pop. 600,000 (mainly Hindus); pop. (town), 13,000.

Shin, Loch, a lake of Scotland, in the south of Sutherlandshire, stretching north-west to south-west about 24 miles, with an average breadth of about 1 mile, and discharging to the Kyle of Sutherland by the River Shin.

Shingles, or Herpes Zoster, is an acute disease characterized by the appearance of patches on which groups of vesicles appear, accompanied by considerable pain and slight general disturbance. The area of skin affected corresponds with the area supplied by a spinal nerve. The first symptom is neuralgic pain in the region where later the eruption appears. The eruption is usually unilateral, and when the vesicles appear they should be protected by a suitable dressing. Later the neuralgic pains become more severe, and may be present for a considerable time, especially in elderly people, in whom they may persist for weeks. In treatment two things are aimed at: prevention of the vesicles being secondarily infected and thereby becoming purulent, and the relief of pain. For the latter in the milder cases aspirin or some similar preparation is usually sufficient, but in long-standing cases X-ray treatment is of great benefit.

Shipbuilding. *General History.*—Primitive man, watching a drifting log, would easily come to use a log raft, and then a log canoe. But the transition from that to the skin boat—the first structure which supported man by its *shape*, not by the buoyancy of its materials—marked the inception of shipbuilding. The covering of skins over a framework of bent saplings was the first 'ship' of the early world, and this was probably in use by 10,000 B.C. By about the year 4000 B.C. planked galleys were built in Crete capable of carrying horses from the mainland and from Egypt. *Phœnicia* played a considerable part in the development of shipbuilding, her vessels being sufficiently seaworthy to venture beyond the Straits of Gibraltar. These boats were open galleys with high bow and stern, and wickerwork was used to raise the height of the bulwarks in stormy weather. Fir, cedar, oak, and boxwood were the principal woods used. The boats of *Babylonia*, about 1100 B.C., were of willows covered with hides and smeared with bitumen to render them waterproof; *Assyrian* vessels of the same period were, however, made of planks of poplar, fastened with wooden pins or trenails, and even, in some instances, by iron nails. The saw, pickaxe, and adze were in use by this time. *Egyptian* vessels had a high bow and poop, which overhung the water; they were used mainly for river navigation, although (about the years 2800 B.C. and 1600 B.C. respectively) two expeditions were made by sea to Somaliland. Herodotus (484 to 423 B.C.) gives a curious description of the building of Egyptian vessels. He states they were constructed of acacia-wood planks about 3 feet long, arranged like bricks; these were fastened by long bolts until the hull was complete, and then cross planks were laid from side to side. The seams were caulked with papyrus. A peculiarity of Egyptian vessels was the high double-spar mast, shaped like an inverted V and secured by backstays. The boats were fitted with one large square-sail, oars being the main means of propulsion. The most common vessel of the *Greeks* was the *trireme*, carrying some 170 oars arranged in three banks. The bows of the war vessels usually terminated in a ram, modelled after a boar's head. Greek vessels were fitted with a forecastle; merchant ships were built of pine and keels were made of oak, as it was customary to haul the boats ashore at night. In all the early Mediterranean ships the wood was worked while green, as it was then more pliable; the planking was from 2½ to 5¾ inches thick. Bronze, iron, and wood fastenings were used; seams were caulked with tow, and the vessels were coated below the water-line with pitch or crude wax. The *Romans* during the Punic Wars produced galleys in vast numbers; in 261 B.C. they built 180 large war vessels in two months; in 256 B.C., after a naval disaster, they replaced their fleet with 220 new ships within three months, and in 241 B.C. they built a new war fleet of 200 vessels; their mercantile shipbuilding was unimportant.



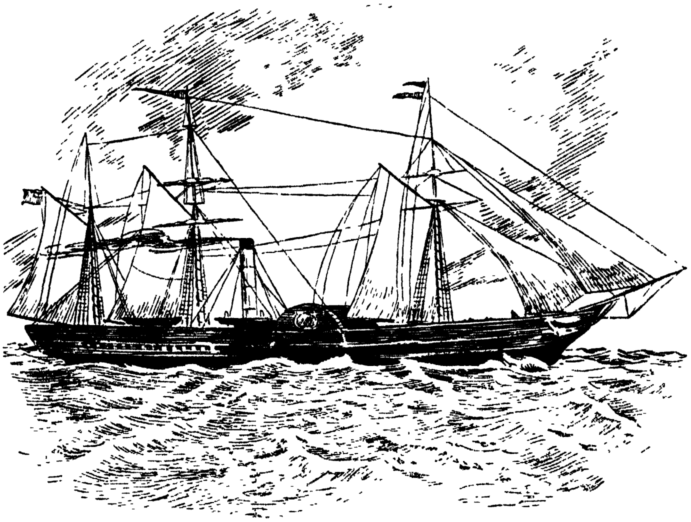
Fifteenth-century 'Caravel', after a delineation by Columbus in the Latin translation of a letter dated 1st March, 1493, in the library at Milan.

Practically no progress in shipbuilding was made after the fall of Rome until the founding of the Republics of Venice, Genoa, and Amalfi, which were firmly established by A.D. 1000. Their vessels were a distinct advance upon the open galleys of the Greeks and Romans, although apparently they continued to use the early Egyptian rig of one large square-sail attached to the mast at the centre of its top side. In 1268 the Republics built some vessels for Louis IX of France, of 110 feet in length with two decks. By the sixteenth century the Genoese were building great three-masted *carracks* of 1200 to 1500 tons burthen. It was the knowledge of such large vessels, gained during the Crusades, which led to the development of shipbuilding in England. Previous to the Crusades the Northern craft were of the viking *long-ship* type —open boats of about 100 feet in length, with very small freeboard, and having one square-sail similar to the Egyptian and Phœnician types. After the Crusades, however, the open galley gave place to the decked *galleass*, the *carrack* (similar to that of the Genoese), and finally to the *galleon*, which was built with an inward sweep of the topsides, or 'tumble home', owing to the introduction of cannon. The *Great Harry*, burnt accidentally in 1553, was the greatest English vessel of her time, of 1000 to 1500 tons burthen and carrying over 700 men. The *Santa Maria* of Columbus, only sixty years earlier than the *Great Harry*, was only 128 feet long overall, and of 285 tons.

After the voyages of Columbus radical changes in construction became necessary to meet the new conditions. The galleon died out by the eighteenth century, but the elements of its design were continued in the great *ships of the line* which brought England victory at Trafalgar. Before the introduction of copper sheathing (1761), vessels were sheathed with thin fir deals, the bottoms being first coated with tar and hair, felt, or ground glass. It was exceptional for a vessel to remain in service for more than about twelve years, principally owing to the ineffectual methods of preserving timber. The method adopted at the beginning of the eighteenth century was to char the inner surface of the log, while the outer surface was kept wet. This was superseded by the stoving system, in which timber were buried in wet sand and then heated, and in 1736 the steaming method was introduced. The sailing ship finally reached its zenith in the famous *tea clippers* of the latter part of the nineteenth century.

The inventive work of Velasco de Garay as early as 1543, Denis Papin in 1707, the Marquis de Jouffroy in 1783, James Rumsey of America in 1786, and Miller and Taylor in 1788, all of whom experimented with steam-driven vessels, paved the way for Symington's steam tug, the *Charlotte Dundas*; but it was not until 1812 that the *Comet* of Henry Bell proved the practical commercial value of the steam-propelled vessel. The introduction of iron ships in 1822, and the supplanting of iron by steel (1870), have raised shipbuilding standards very high. The Atlantic was first crossed under steam alone in 1838, and first crossed by an iron steamer in 1843. Since that time development has been rapid and continuous. For general history of naval shipbuilding progress, see *Navy* (*Material Composition of Navies* section).

Mercantile Shipbuilding: Design.—As a general rule the owner specifies the weight of cargo it is desired to carry, the speed of the vessel, and the draught, this last being generally governed by the depth of water available at the ports of call. With these figures at his disposal, the naval architect proceeds to fix the dimensions necessary to comply with these conditions, generally basing his design upon some similar ship whose performance is known to be satisfactory. The principal drawing which he prepares is known as the *sheer draught*, and shows the shape of the vessel at various sections throughout its length, while numerous other plans, showing the arrangements of the various decks, the disposition of the plating, and the methods of supporting it, are also required.



The *Britannia*

The first steamer of the Cunard Line to make the Atlantic passage. Length, 207 ft.; beam, 36 ft.; displacement, 1156 tons; engines, 740 h.p., giving a speed of 9 knots.

Construction.—In the old days, when wood was the medium of construction, vessels were invariably built on what is known as the transverse system, a method of framing which, with important variations (due to the great physical differences in the materials employed), is still retained in the great majority of cargo and passenger vessels. Mild steel having a tensile strength of about 30 tons per square inch is now almost universally used in the construction of ships. In a few special cases a steel having a somewhat greater strength, about 35 tons per square inch, has been used, but its greater cost and limited application prevent its general adoption. The general construction of a transversely framed vessel will best be understood by reference to figs. 1 and 2, which show the profile and midship section of an ordinary two-deck cargo steamer. Above the upper deck are fitted a poop, bridge, and forecastle, these being provided to render the vessel more seaworthy by providing platforms well above the level of the sea, while the bridge also serves as a protection to the openings in the deck leading to the machinery space. It will be observed on the profile that the machinery, situated amidships, is separated from the cargo spaces by transverse partitions, known as watertight bulkheads, and that similar bulkheads are fitted near each end of the vessel and also at the middle of the forward and after holds. The foundation of the structure, running continuously fore and aft, is the keel plate, K, upon which stands the centre girder, CG, to which the transverse floor plates, F, are attached. The floor plates are simply deep vertical plates, having on their upper and lower edges angle bars to which the plating of the inner and outer bottoms is attached. The floor plates terminate on their outboard edges on the margin plate, M, which serves as a foundation for the side transverse frames, SF; the transverse frames, which extend continuously from the margin plate to the top deck, are spaced from 24 inches to 30 inches apart, according to the size of ship, and give the form of the vessel at each point. The framing may be of various forms, an angle with a reversed angle (frame and reversed frame), a channel section, or a bulb angle (see fig. 3). At their upper end the frames are joined by horizontal beams, B, which assist the frames to resist any tendency to change of transverse form, and which serve as a platform or deck. In the case of a large vessel, one or more decks may be fitted below the upper one, either for purposes of strength, or for convenience in stowing certain cargoes, or for housing passengers. Vertical change in transverse form is resisted by the pillars, which tie the top and bottom of the structure together and support the beams in carrying any load that may be placed on them. The longitudinal strength of

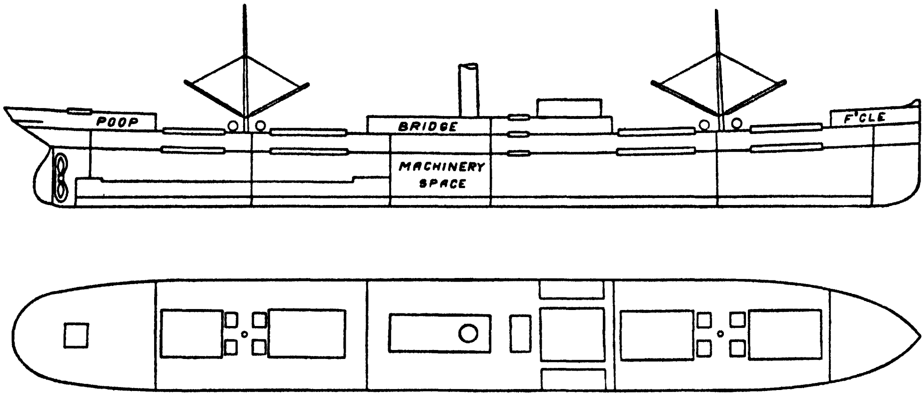


Fig. 1

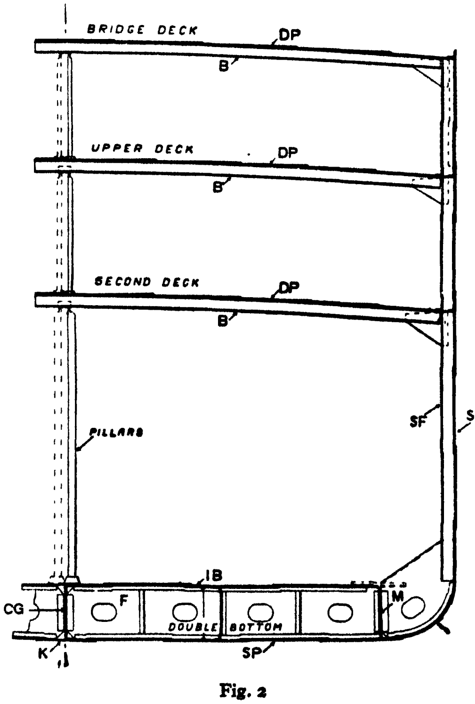
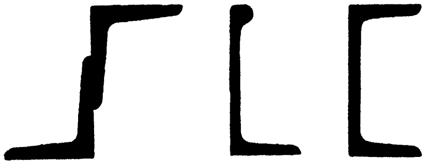


Fig. 2



Angle with reversed angle

Bulb angle

Channel section

Fig. 3

the ship is furnished by the outer or shell plating and the plating of the decks. The most important part of all (that giving the vessel its floating power) is the shell plating, SP, which consists of strakes of plating riveted to each other and to the flanges of the transverse frames. The inner bottom plating, IB, and the deck plating, DP, are fitted in a similar manner to the shell plating. The space between the inner bottom and the shell plating, known as the double bottom, affords a valuable increase in the safety of the vessel in case of grounding, and serves conveniently for the carriage of water-ballast or oil fuel.

Before the actual erection of the vessel can be commenced, much preliminary work requires to be done in the shaping of the material and the punching of the rivet holes. After the working plans have been prepared, the form of the vessel at various sections is drawn out full size in the mould loft, where moulds made of thin wood battens are prepared showing the exact shape of each plate and the positions of the rivet holes. In recent years much progress has been made in perfecting the methods of preparing moulds, and it is now possible to prepare all the plating in a vessel, despite the variations in form from place to place, ready for erection before the keel plate is laid. After the material has been prepared, preparations for erection are made at the building berth, the first step being the provision of the keel blocks on which the vessel is to rest. These blocks, which are laid horizontally in a transverse direction, are spaced about 4 feet apart, and are built up to a height of about 5 feet. After the keel plate has been laid, the centre girder is erected, and the floors placed in position. The inner bottom plating and margin plate are then laid, and the side frames and deck beams erected. Lastly, the shell plating and deck plating are fitted. The various parts of the structure are connected to each other by rivets ¾ inch to 1 inch in diameter, spaced four diameters apart in seams where watertightness is necessary, and six to seven diameters apart elsewhere.

Launching.—The launching of the vessel is an operation calling for much careful arrangement and forethought. The launching ways, which are built for the full length of the vessel, and which extend well into the water, are usually placed at about one-third of the half-breadth of the vessel on each side of the centre. The fixed or standing ways are built up similar to the keel blocks, and support on their upper surfaces a continuous built-up wood log about 30 inches wide. The upper surface of the standing ways is coated with tallow, and a sliding way of similar dimensions to the standing way is laid on the tallow. The ship is supported by shores from the sliding ways, which are held in position until the moment of the launch by a trigger whose release permits the vessel to slide into the water. After the launch the vessel is completed by the installation of the engines and boilers, and the completion of the fittings on the decks and in the accommodation.

Oil-carrying Vessels.—In recent years the increasing use of oil in all countries has given a great impetus to the construction of vessels intended to carry oil in bulk, a branch of shipping which is growing yearly in importance. The oil is carried in tanks about 30 feet in length, formed by the structure of the vessel, the tanks being subdivided by a longitudinal centre-line bulkhead, the machinery being fitted at the after end. The form of construction usually adopted is somewhat different from that described for cargo vessels, the main framing being fitted in a fore-and-aft direction instead of transversely, this system of framing being usually called, after the designer, the *Isherwood* system. The main oil tanks are about 30 feet long, and two deep webs or transverses are fitted in each tank, these transverses forming strong rings right round the vessel. The longitudinal frames and beams are spaced 30 inches apart and pass through the transverses, but are cut at the transverse bulkheads, to which they are efficiently bracketed.

Tonnage.—The origin of the term 'tonnage' as applied to ships dates back to the time when the carrying capacity of a vessel was measured by the number of tuns of wine which could be loaded in her. In modern times the word has been used to denote various measures of capacity, of which the principal are: (*a*) *Gross tonnage*, a measure of the internal capacity of the ship, including erections, found by dividing this capacity (in cubic feet) by 100, i.e. 1 ton is equal to 100 cubic feet. (*b*) *Net tonnage* (upon which harbour dues are payable), determined by deducting from the gross tonnage allowances for machinery space and crew accommodation. (*c*) *Displacement tonnage*, denoting the actual weight, in tons, of the vessel and cargo when floating at the load draught. (*d*) *Dead-weight Tonnage*, the weight, in tons, of the load, including cargo, coal, and stores, which the vessel can carry when floating at the load draught. Dead-weight tonnage is equal to the difference between displacement tonnage and the weight of the ship and machinery (including the water in the boilers, but not including any coal or stores).

Freeboard is the height of the side of a ship above the water-line at the middle of her length, measured from the top of the deck at side. Freeboard is given to a vessel as a margin of safety to ensure that a reasonable proportion of the vessel's structure is above the load water-line. The actual freeboard for a particular vessel is dependent upon several factors, the principal of which are: type of vessel, structural strèngth, and erections on deck.

Stability is the moment of the force, per unit angle of inclination, which, when the ship is inclined, tends to cause her to come back to the upright position. Stability is dependent upon the design of the vessel, but even more upon the manner in which the cargo is stowed.

Trim is the difference between the draught forward and the draught aft.

Strength.—For the purpose of strength calculations a ship may be considered as a hollow girder, and its strength calculated on the basis usually adopted for such structures. The forces acting on the ship are the supporting forces due to water pressure, and the weight of the ship and cargo acting in the downward direction, and as these forces do not balance at all points in the length of a ship, a bending moment on the structure is produced. Two conditions are usually assumed: one, where the vessel is poised on the crest of a wave, and the other, where the vessel is suspended across the hollow between two waves, these conditions being known as 'hogging' and 'sagging' respectively. So many assumptions have to be made in calculations of this kind that the results cannot be said to have an absolute value, but form a basis on which new designs can be compared with vessels whose performance is known to be satisfactory. The strength of the side frames and deck beams is calculated as for ordinary beams, the actual stress permissible being based upon previous similar vessels. In general, however, the dimensions of the various parts of the ship's structure are determined by the Rules of the Classification Societies, the chief of which is Lloyd's Register of Shipping. The requirements for novel designs are normally determined by comparison with these Rules.

To illustrate the general properties of an ordinary cargo ship of 5000 tons gross and 8000 tons dead-weight, similar to that illustrated in fig. 1, the following particulars may be given: length, 400 feet; breadth, 52 feet; depth to upper deck, 31 feet. Freeboards: amidships, 6 feet; forward, to upper deck, 16 feet, top of forecastle deck, 24 feet. Draught, 25 feet 1 inch; displacement at this draught, 11,400 tons. Weight of hull, 2710 tons; weight of machinery, 570 tons. Total light weight, 3280 tons; dead-weight (including coal), 8100 tons. Gross tonnage, 5200; net tonnage, 3200. Coal bunkers, permanent and reserve, 1414 tons. Water ballast, 1423 tons. Cargo capacity in holds, 450,000 cubic feet. Crew, 47. Machinery, one set of triple expansion engines of 3000 maximum h.p., and 2500 continuous h.p. at sea. Maximum speed, 11½ knots; continuous speed at sea, 11 knots.

Naval Shipbuilding.—War-ships can be divided into three groups: battle-craft, torpedo-craft, and cruisers. The first consists of battle-ships and battle-cruisers, which cruise in fleets, carry few torpedoes, rely on big guns for offence, and on smaller guns, armour, and minute subdivision for defence. Both are fitted with armour on sides and decks, but in the battle-ship this protection is thicker than in the battle-cruiser, which has higher speed. Torpedo-craft include destroyers and submarines. The former are long, light, and fast, and are used for attacking battle-craft with torpedoes, and to repel similar enemy vessels with light guns. Submarines navigate on the surface or submerged, and in the latter condition attack enemy vessels with torpedoes. Guns are fitted on submarines for use in surface actions. Cruisers are fast, lightly armoured, have medium sized guns, and carry torpedoes. Their duty is to scout around the battle-fleets, to ascertain and report the enemy's positions, and to engage enemy cruisers and torpedo-craft.

Steel is used for all structural portions, and is generally mild steel with a tensile strength of 26 to 30 tons. Where greater strength is required, high tensile steel with a strength of 33 to 38 tons is used in larger war-ships, and with 37 to 43 in destroyers. Bars of various shapes of transverse section are employed, but the common are angle bars with a section like the letter L, zed bars with section as letter Z, and bulb angles with a bulb at the end of the longer flange of the angle.

The primary function of the *bottom plating* is to preserve buoyancy and prevent water entering the interior. It is constructed of steel plates 24 to 36 feet long, 5 to 7 feet wide, the width being placed transversely. The thickness varies with size of ship and position, and in destroyers is ⅕ to ¼ inch amidships and ⅙ to ⅐ inch at ends. In battle-craft and cruisers the corresponding figures are ¾ to 1 inch and ⅜ to ½ inch. The plates are arranged in *strakes*, each extending the whole length, and consisting of the series of plates whose ends are joined together. The strakes are arranged on the *raised and sunken* system, i.e. alternate strakes lap over the strake between (figs. 4, 5, 6). The edges of adjacent plates are riveted together with two rows of rivets, and the ends—*butts*—by short lengths of plates—*butt straps*—on the inner surface, and riveted to the two connected plates by two or three rows of rivets. The latter have their points on the outside, and are cut off flush with the surface. The stem and stempost connect the strakes on both sides at the extremities. All edges and butts of the plating are made watertight by caulking, i.e. by forcing a portion of the material on the nearest edges against the surfaces or ends of plates adjacent. The central strake of plating is termed the *flat keel*, that on either side the *garboard*, and the two, one each side, adjacent to the upper deck the *sheer* strakes. These special strakes contribute largely to the longitudinal strength, and are thicker than the remainder. The flat keel is usually doubled over the amidships portion of the length, i.e. two strakes are fitted one inside the other, the inner being of less width than the outer, to allow the garboards to lap on the latter. The lowest strakes of bottom plating and the sheer strakes, for the middle two-thirds of ship's length, are of high tensile steel. The remainder are mild steel.

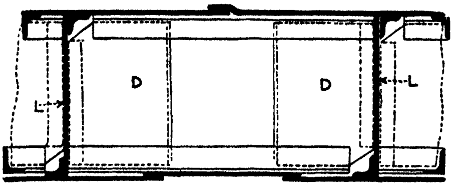


Fig. 4.—Bracket frame

Battle-craft and cruisers are fitted with an *inner bottom* distant 2½ to 6 feet from the outer, the space between being the *double bottom*. Its purpose is to restrict the entry of water into the ship if the outer plating is damaged. It also serves as stowage for water and fuel. In cruisers it extends over the boiler- and engine-rooms, its upper boundaries being the upper deck (fig. 7). In battle-craft its extent is about three-quarters of the ship's length, covering the magazines and shell-rooms. Transversely it extends to the protected bulkheads (fig. 9). In battle-craft its thickness is from ⅜ to ⅝ inch, generally arranged as for outer bottom plating except that the edges of plates are *joggled* (figs. 4, 5, 6) and butts lapped. The thickness in cruisers is ¼ to $\frac{7}{16}$ inch. In destroyers it is not fitted. *Submarines* have two hulls, the inner or *pressure* hull, circular in section and ½ to 1 inch thick, and the outer hull, shaped as for surface ships and ⅛ to ¼ inch thick (fig. 8). The space between the two hulls is divided by partitions into ballast tanks and oil-fuel tanks. The former are empty when the

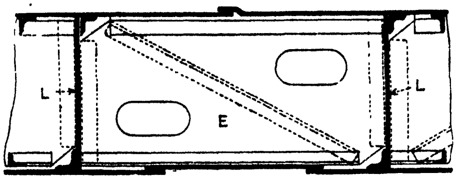


Fig. 5.—Lightened plate frame

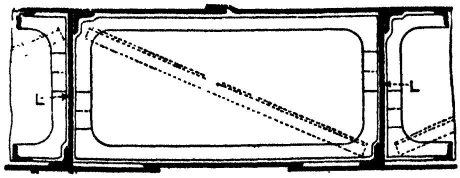


Fig. 6.—Watertight frame

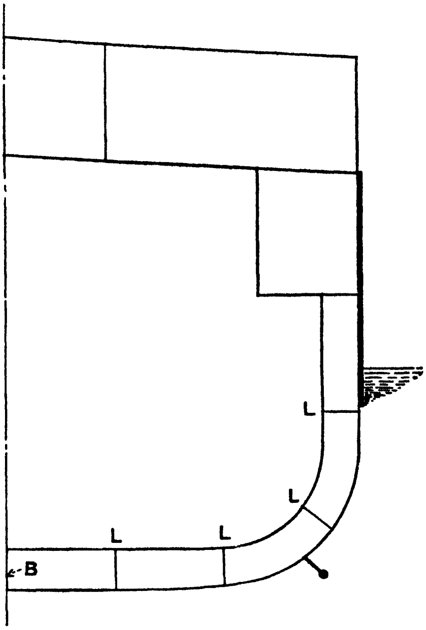


Fig. 7.—" Dragon "

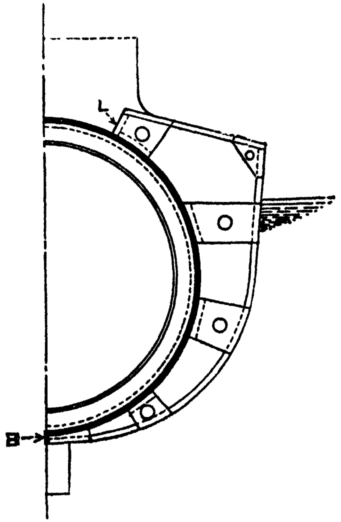


Fig. 8.—Submarine

submarine is on the surface, and she is submerged by flooding the ballast tanks through flooding valves, the air escaping overboard through vent valves. When submerged the latter are closed, and the vessel is brought to the surface by allowing compressed air to enter the tanks, expelling the water through the flooding valves.

As a result of experience during the European War, *bulge protection* was fitted to battle-craft and other ships to minimize injury by torpedo and mine explosion. This protection (fig. 9) virtually amounts to the addition of a third bottom at the sides. The space between the inner and outer parallel lines is filled with water.

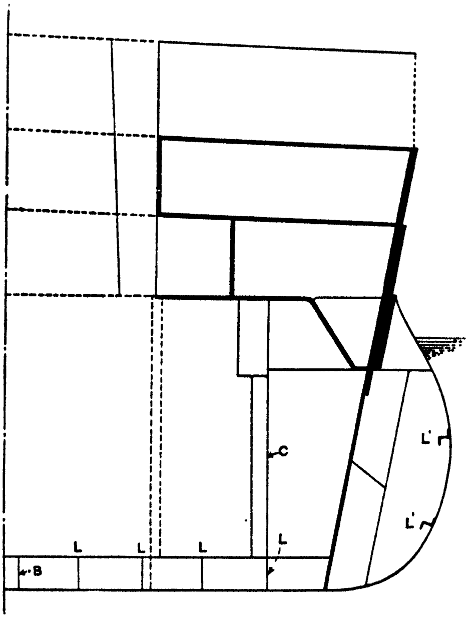


Fig. 9.—" Hood "

The *framing* assists the bottom plating against water pressure, and is of two types, transverse and longitudinal. The former corresponds to a boat's ribs, being fitted perpendicular to the keel. The distance between transverse frames is 18 to 21 inches in torpedo-craft, 4 feet in cruisers and the double bottom of battle-craft, and 8 feet at the ends of the latter. The longitudinal frames run fore and aft, meeting the transverse frames perpendicularly. The bottom plating is thus stiffened by rectangular panels of framing, the breadth of rectangles being the distance between transverse frames, and length that between longitudinals. Fig. 10 shows the framing of a destroyer with transverse frame spacing of 21 inches, the frames being zed bars 4 inches deep and $\frac{1}{8}$ inch thick, with the outer flange riveted to bottom plating. The zed section is maintained over the vertical side, but at the bilge the web is cut, forming two angles whose distance apart gradually increases, and at middle line is 15 inches. The triangular space between them is filled with a floor plate, A, $\frac{1}{8}$ inch thick, riveted to both. Every sixth frame is a web frame of plate 8 inches deep and $\frac{5}{16}$ inch thick, with angle on outer edge to connect it to bottom, and one on inner edge to stiffen it. The frames extend in one length from upper deck to middle line, or from lower deck where latter is fitted, another zed being fitted between forecastle or upper deck and lower. The vertical keel, B, at middle line is the main longitudinal, forming with the flat keel the backbone of the structure. 18 inches deep and $\frac{7}{16}$ inch thick, it is connected to the flat keel by double angles, and by vertical angles to the floor plates. Two angles are riveted to its top edge and also to a plate, D, on either side laid along and fastened to the angles at upper edge of floor plates. Four other longitudinal frames, L, are fitted on each side of ship, standing normal to the bottom, and consisting of short plates connected by angles to the bottom and the floor plates if they meet them. The inner edges of the short plates project 3 or 4 inches inside the frames, and are connected to a continuous angle or zed bar. The girth decreasing towards the ends, the number of longitudinals is decreased. The lower deck forms a continuation of one on each side.

The transverse frames of a *submarine* are 18 inches apart, those to the pressure hull being zeds 6 inches deep in one ring. Those to the outer hull are light angles connected across by short plates to angles on outside of pressure hull (see fig. 8). Longitudinals are fitted at keel between the two hulls, B, at the tops of tanks, L, between hulls, and under engines. The principal strains are transverse, due to water pressure when submerged. The flooding valves to tanks are always open, and no strain comes on the outer hull. The pressure hull is subject to full pressure, and hence its thickness and stiffening.

In battle-craft the framing for the length of ship over which the double bottom extends is fitted therein. The longitudinals (L, fig. 9) are 6 to 8 feet apart, depth the distance between bottoms, and thickness $\frac{3}{8}$ to $\frac{5}{8}$ inch. Standing normal to the ship's bottom, they are worked with plates as long as practicable, the ends of plates being well riveted together. Each connects by a single angle at its outer edge to the outer bottom, and similarly to the inner. The longitudinal at the middle line—the vertical keel (B, in fig. 9)—has an angle on either side for connections top and bottom. In the *Hood* the vertical keel is formed of two plates each 21 inches from middle line. Beyond the double bottom it is a single plate, as in other ships.

Alternate longitudinals are tight, and divide the double bottom into compartments 12 to 16 feet wide; the others are lightened with holes large enough for access. The longitudinals, L′, in the bulge (fig. 9) are zed bars. The transverse frames are 4 feet apart, and fitted between consecutive longitudinals. They are of three types, bracket, lightened plate frame, and tight frames. The first two have a boundary framework of four angles riveted respectively to inner and outer bottoms and the two longitudinals (figs. 4, 5, 6) between which they are fitted. In the bracket frames (fig. 4) the four angles are connected across their shorter sides by two plates, D, flanged on the edge; whilst in the lightened plate frame they are connected by one lightened plate, E, with an angle at the back (fig. 5). The tight frames are fitted every fifth or sixth frame, the boundary consisting of two angles extending across a long edge and a short distance up the short edges. The two are connected by a solid plate stiffened across by an angle bar. The angles are carefully fitted around the edges, and caulked against the plates. The tight frames divide the double bottoms transversely every 20 to 24 feet, and with the tight longitudinals form compartments 12 to 16 feet wide and 20 to 24 feet long. Beyond the double bottom at the ends the framing is similar to a destroyer's, except that the zed bars are 6 inches deep and $\frac{3}{8}$ inch thick, 3 feet apart, and are cut into portions by the protected and strength decks. Behind the armour belt the frames are 2 feet apart, of heavy channel section, and well secured to the beams of the decks. In cruisers the arrangement of framing is similar to that for battle-craft, the plates and sections used being lighter (fig. 7).

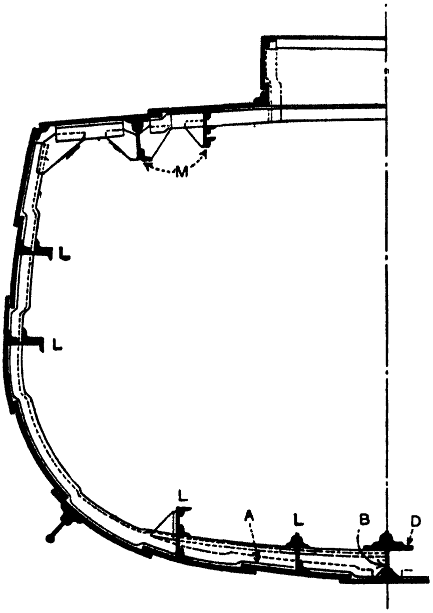


Fig. 10.—Destroyer

All *decks* are made watertight by constructing them of steel plating. Some of the decks in battle-craft have much thicker plating than others, and are termed *protected* decks. The decks at the upper edge of the armour belt and at the bottom are protected decks. The former runs nearly level across the ship, but the latter is level and above water for the greater portion of the breadth, and then slopes down to the edge of belt 4 or 5 feet below water. In the *Hood* the deck between the two is also protected, but its thickness is 1 inch, as compared with 2 inches for the others. Before and abaft the armour belt, the deck just above the outside water is also protected, the thickness forward being 1 inch, and aft 3 inches. The purpose of these decks is to protect the vitals, the buoyancy at the ends, and the steering-gear aft. Projectiles striking them at a small angle ricochet in cases when they would pierce a thin deck. The uppermost continuous deck, even if not protected, is made thicker than the ordinary deck, as it is an important factor in the strength of the ship. Ordinary decks are covered with relatively thin plating sufficient to secure tightness or to meet local conditions. The deck plating is supported by the deck beams spaced the same distance apart as the transverse frames, to which they are secured at their ends by knees or bracket plates, triangular in shape, with the longest edge flanged, and the two others secured to beam and frame respectively (fig. 11). The uppermost decks are not straight transversely, but are given a *camber*, i.e. are portions of circular arcs of large radius. This causes water on them to drain to

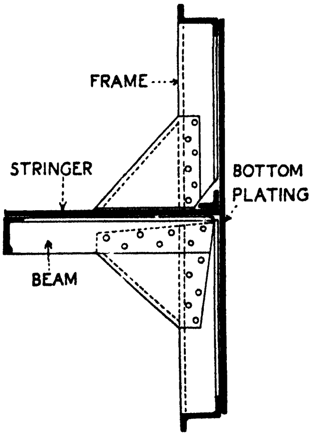


Fig. 11.—Deck connection

the deck edges into the scuppers overboard. Interior decks are flat. The uppermost continuous deck is also given a *sheer*, i.e. the fore and after ends are higher than amidships, and the fore end higher than aft. This sheer gives a good appearance to the vessel in profile view. The beams are of angle-bulb section, and are assisted in supporting the decks by the bulkheads, but where this support is lacking, *pillars* are fitted. These are steel tubes with solid ends secured to the beams at the top and to the plating of the deck below. The pillars between the different decks are arranged in vertical lines, the better to distribute the weight over the adjacent structure. The plating of a deck is laid with the lengths of plates fore and aft, the strake at each side on the outside edge being termed the *stringer* (fig. 11). This is connected to the strake of bottom plating, against which it fits, and on strength decks is usually thicker than the remainder. Protected and strength decks are worked continuously, that is, they are not cut by the bulkheads, but the latter are cut through by them. Similarly, the transverse frames are divided by these decks, the portion of frame below the deck being secured to the deck beam, and that above by a bracket plate to the deck plating (fig. 11). Ordinary minor decks are cut by the main bulkheads, and the deck plating is laid between the latter. The transverse frames pass through them, slots being cut in the plating to allow this, and angles being fitted around to secure tightness.

All holes cut in decks for access purposes are fitted with watertight covers, which, when closed, are hove down on rubber or other material by nuts and screws. Those giving access to spaces continually in use, such as store-rooms and magazines, have hinged rectangular covers, and the opening is fitted around its edge with a vertical boundary or *coaming* to prevent water entering. The compartments not requiring constant opening are fitted with manholes of oval form, the cover being of the same shape, larger than the hole, and secured by studs and nuts. Principal decks open to the weather are covered with teak planking; smaller weather decks and those in the interior are covered with corticine, cement and tiles being used in galleys, wash-places, &c. Destroyers have their weather decks covered with corticine, except over engine- and boiler-rooms, where coir matting is used. In these vessels the upper deck plating for the length of the engine- and boiler-rooms, and transversely from the deck edges to the lines of funnel openings, is $\frac{3}{8}$ to $\frac{7}{16}$ inch thick; inside these lines it is $\frac{7}{40}$. Under the forecastle it is $\frac{7}{40}$ inch, with $\frac{1}{4}$-inch stringers, and aft $\frac{1}{4}$ to $\frac{5}{16}$ inch, gradually reduced to $\frac{3}{20}$ inch at end. The plates are laid with their outboard edges overlapping the inboard edges of the plates outside, the lap being riveted through (see fig. 10). The butts of plates are double strapped. Two longitudinal girders, M, one 12 and the other 15 inches deep and $\frac{7}{40}$ inch thick, are fitted on each side under the deck plating. The beams are angles 8 inches deep, except where a transverse web frame is fitted where the beam has the same construction as the frame. The forecastle and lower deck plating is $\frac{3}{20}$ inch thick, with angle beams $3\frac{1}{2}$ and 2 inches deep respectively. Longitudinal girders are fitted under both decks, in the former to assist deck when guns are fired, and in the latter to take heels of pillars. In cruisers the upper deck plating over boiler- and engine-rooms, and from deck edges to line of funnel openings, is $\frac{7}{8}$ inch, the various plates being laid with edges together and connected by strips $\frac{1}{2}$ inch thick above and below, with the butts double strapped and treble riveted. The upper deck plating elsewhere is $\frac{1}{4}$ inch, which is also that of remaining decks. The upper deck beams are $6\frac{1}{2}$ inches deep angle bulbs; in other decks the depth is $5\frac{1}{2}$ inches. A girder is fitted on either side under upper deck. The thicknesses of the protected decks of the *Hood* have been stated; others are $\frac{3}{10}$ to $\frac{1}{2}$ inch. In the protected decks whose thickness is greater than 1 inch, the plating is fitted in two equal thicknesses. Each edge of the upper plating is placed at the middle of the lower plate under that edge, being riveted through to that plate, the latter thus acting as a connection to the former, and vice versa. The ends of the plates are similarly arranged, but in addition butt-straps are fitted above and below the two thicknesses.

In *submarines* only one interior deck is fitted, and that only over a portion of the length. The plating is $\frac{3}{8}$ inch thick, beams angle bulbs $4\frac{1}{2}$ inches deep, and stiffeners of the same size are fitted fore and aft on tanks to assist the plating to withstand pressure of 50 lb. per square inch, used when blowing water out of the tanks. The uppermost deck outside pressure hull is narrow and of $\frac{1}{8}$ inch galvanized plating. The upper continuous deck, being the strength deck, in battle-craft, cruisers, and destroyers, has high tensile steel plating.

Watertight bulkheads, transverse and longitudinal, are important in the subdivision of a ship, and, as they prevent water from passing from one flooded compartment to another, are stiffened to withstand water pressure on either side. Transversely the former prevent changes of form, whilst both distribute the weights above them to the surrounding structure. Main transverse bulkheads include collision bulkhead, those bounding engine- and boiler-rooms, one aft, and in battle-craft the two at the ends of double bottom. They extend from outer, or inner bottom where fitted, to the lowest protected or strength deck, and are continued above by bulkheads fitted between decks, and below by tight frames in double bottom. At the ends of a ship they are stiffened by the decks meeting them, but in engine- and boiler-rooms this support is lacking, and special stiffening is fitted. Such bulkheads in destroyers are of plating placed lengthwise across ship, ⅛ inch thick for upper strakes, and $\frac{3}{20}$ inch for lowest, stiffened by vertical 5-inch zeds, 3 feet apart, and horizontal girders 8 inches wide, $\frac{3}{20}$ inch thick, 3½ feet apart, slotted over vertical zeds, secured to plating by an angle, and with a continuous angle on free edge. In cruisers the plating is ¼ inch thick, with top strake $\frac{7}{40}$ inch, and lowest $\frac{3}{10}$ inch, stiffened by vertical zeds 5 inches deep, ⅜ inch thick, and 24 inches apart. In battle-craft the plating is $\frac{7}{20}$ inch thick, the lowest $\frac{17}{40}$ inch, stiffened by vertical 12 inch deep H-bars, one on front and one on back, 6 feet apart, with 9-inch angle bulbs 2 feet apart between. Bulkheads stiffened by decks meeting them are ⅛ inch thick in destroyers, $\frac{7}{40}$ to ¼ inch in cruisers, and ¼ to ⅜ inch in battle-craft, stiffened by angles 2 to 2½ feet apart, or by zeds where they support heavy weights. All plates have lapped edges and butts, the former single- and latter double-riveted, and all main stiffeners are bracketed top and bottom to the structure. In cruisers and destroyers the longitudinal bulkheads are small and of same thickness plating, and stiffened similarly to the transverse bulkheads at ends. In battle-craft the longitudinal bulkheads at sides of boiler-rooms are continued to the ends of double bottom. In the *Hood* the bulkhead (c, fig. 9) is ½ to ¾ inch thick, stiffened with vertical channel bars 6 inches deep, spaced 4 feet apart, and secured by brackets to beams above and to inner bottom below. Under barbettes the stiffeners are 2 feet apart. The air-space bulkhead inside c is ¼- to $\frac{3}{10}$-inch plating, stiffened by 3-inch angles and plate frames between it and c. The sloping bulkhead outside c is 1½ inches thick, formed of two ¾-inch plates with lengths vertical, and stiffened by 12-inch deep H-bars placed vertically 4 feet apart. In submarines the bulkheads, tested to 35 lb. per square inch, are formed of ⅜-inch plating, stiffened with vertical web-frames 10 to 12 inches deep and 24 inches apart. Watertight doors are fitted in the bulkheads in spaces above the water-line, but not below. Doors are made tight by forcing their edges by clips and wedges against rubber. Each compartment below water is tested by filling it with water with a head equal to 5 to 12 feet above water-line; the bulkheads above water-line are tested by playing a hose on them.—BIBLIOGRAPHY: G. S. Baker, *Ship Form Resistance and Screw Propulsion*; Sir J. H. Biles, *The Design and Construction of Ships*; E. L. Attwood, *Theoretical Naval Architecture*; A. Campbell Holms, *Practical Shipbuilding*; W. J. Lovett, *Applied Naval Architecture*; Lloyd's Register, *Rules for the Building of Steel Ships*.

Shipka Pass, a pass in the Balkans, between Philippopolis and Plevna, 4870 feet above the sea, the scene of a desperate struggle during the Russo-Turkish War (Aug. and Sept., 1877). In his futile endeavours to take Fort Nicholas, at the summit of the pass, from the Russians, Suleiman Pasha lost 20,000 of his best men.

Shipley, an urban district and market town of England, in the West Riding of Yorkshire, on the Aire; served by the Midland and Great Western Railways. Manufactures include worsteds and woollens. Pop. (1921), 28,800.

Ship-money, an impost levied at various times in England, especially on the seaports, for the purpose of furnishing ships for the king's service. Elizabeth, when threatened by a Spanish invasion, required various ports to fit out ships. Having lain dormant for many years, the tax was revived by Charles I, who in 1634 levied it on the coast towns, and in 1635 issued writs for ship-money all over the kingdom. The tax met with strong opposition, and the refusal of John Hampden to pay the twenty shillings at which he was rated was one of the proximate causes of the Civil War.

Shipping. *General.*—Mercantile shipping, as a general term, includes all ships, irrespective of size, which are engaged in the transport of goods or passengers, and despite the standard statistical classification by nationalities, and various subdivisions into lines or groups of lines, the ship remains the unit, and upon each unit the success or failure of any mercantile shipping venture will depend. In navies, and in ships attached thereto, there is a definite 'drill' which is capable of welding any convenient number of ships, not infrequently a collection of vessels widely divergent in size, into a mobile, elastic weapon or unit capable of carrying out definite operations conceived and controlled by one individual; but in the mercantile marine each ship is independent, a unit in itself, and much therefore depends upon the command and personnel generally, the state of the ship and its capabilities, the cargo if any, the nature of the voyage, the weather in which it is accomplished, and the part of the world to which it is made.

Master and Mate.—In the Royal Navy a master was formerly an officer who had charge of the navigation of a ship under the general guidance of the captain. His duties are now performed by an officer known as navigating lieutenant. The term mate is restricted in the Royal Navy to the assistants of certain warrant-officers, e.g. boatswain's mate or gunner's mate.

In the merchant service a master is the duly certificated officer entrusted with the chief command of a vessel, and he is usually dignified with the title of captain. The duties of a master vary greatly according to the line by which he is employed, and the trade in which his vessel is engaged, but, generally, on a voyage, he has duties both as agent for the shipowners and the owners of the cargo, and to a certain extent he has power to bind both. The duties of a master to his owners are first and always to secure the safety of the ship, to avoid injury and to undertake repairs when necessary, and repel all attack upon her from within or without. He must take a pilot on board when required, and he must observe other requirements of the law, e.g. the keeping of the log. The master's authority on board extends to the crew and passengers. He has a claim against the owners, and also a lien on the ship for his wages and disbursements, but his claim for wages comes after that of the seamen, although before any other claims, unless he has made himself personally liable. Under the Merchant Shipping Act there must always be a certificated master. It is in practice quite common for mates to hold masters' certificates, and on a sudden vacancy the first mate succeeds for the time; but the appointment of a master rests with a majority of the shipowners. Certificates of competency are granted as master of a foreign-going ship, first mate of a foreign-going ship, only mate of a foreign-going ship, master of a home-trade passenger ship, mate of a home-trade passenger ship, first-class engineer, second-class engineer. An extra-master's certificate is the highest. The certificate for a foreign-going passenger ship is of higher grade than that for a home-going trade ship, and entitles the holder to go to sea in the corresponding capacity in the home-trade ship, but the converse does not hold.

Examinations for certificates are held, usually by the local Marine Boards at their respective ports, under rules made by the Board of Trade. Certificates are in duplicate, one part being delivered to the person entitled, and the other preserved by the Registrar-General, or other authorized official.

Professional.—Any boy who shows a genuine admiration and aptitude for things nautical may safely be sent to sea. For a time the kaleidoscopic vistas of other lands, the open air, and the delightful unconventionality of nautical life will appeal to the passionate blood of early youth; but a course of hard work, irregular spells below, and not infrequently bad food eaten at all kinds of unearthly hours soon weeds out prospective wasters. The two chief methods of becoming a deck-officer are: (1) apprenticeship from the age of fifteen, a premium frequently being demanded; or (2) deck-service, qualifying by four years' service before the mast, for admission to Second Mate's Certificate Examination. In the *Conway* and *Worcester* training-ships the entry ages are fourteen to sixteen and thirteen to fifteen and a half respectively, fees being between £130 and £140. Two years' training in one of these ships is accepted by the Board of Trade as the equivalent of one year at sea for the purposes of its examination. Nowadays the Board of Trade vision-test is exceptionally difficult and *must* be passed, and the required standard of vision must be maintained *throughout working life.* Before apprenticeship, therefore, boys should be overhauled by an ophthalmic surgeon in addition to passing the first test, so that the risk of failing in subsequent eyesight tests may be reduced to a minimum. Engineers must first serve an apprenticeship in workshops ashore, but junior positions in the engine-room are held by uncertificated men. Eighteen months at sea and regular watch-keeping on main engines or boilers qualify for examination for a Second's 'ticket' if the necessary workshop qualifications are in order. Another eighteen months after passing as Second, if served at sea, qualify for examinations as First, and an Extra-First may subsequently be taken. A highly specialized training in technical schools ashore is essential before either deck or engine-room certificate examinations can be attempted.—Cf. *Examination Regulations* (from H.M. Stationery Office, or any Mercantile Marine Office). See *Seamanship.*

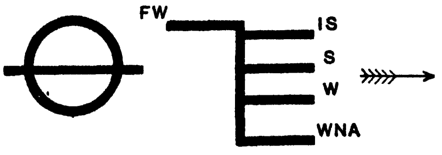
Registration.—Subject to certain conditions, every British ship must be registered, or it will not be recognized as a British ship. The registry forms the record of title, and is also the record of those vessels entitled to fly the British flag. Any ship not registered may be detained; but ships (not exceeding 15 tons burden) employed solely in coastal or river navigation at home are exempt from registry. Newfoundland and St. Lawrence fishing- and trading-vessels (up to 30 tons burden) are also exempt. In Great Britain the registrars at various ports are the chief officers of customs. The property in any ship is divided into sixty-four parts, and not more than sixty-four part-owners can be registered at one time; however, any number up to five persons may be registered, and considered as one person, while a corporation may be registered as an owner. Before registry every British ship is surveyed by a surveyor of ships, and her tonnage ascertained. The surveyor grants a certificate, which is handed to the registrar before registry. Every ship before registry must be marked permanently and conspicuously, i.e. name on each bow, name and port of registry on stern; official number and number denoting registered tonnage, cut on main beam; and a scale of feet indicating her draught of water on each side of her stem and on her stern-post, in letters of required size. Shipwright- and engineer-surveyors furnish declarations to the owner; the former certifies hull, boats, lifebuoys, signals, compasses and deck-shelter, number and division of passengers, the time for which the hull and equipments will be sufficient, and certificates of master and mate. The engineer-surveyor declares upon machinery, limit of weight upon safety-valves, fire equipment, certificates of engineers, &c. These declarations are forwarded by the owner to the Board of Trade when a passenger steamer certificate is issued, with limits as to time and to number of passengers in each part. A duplicate copy of this certificate, cancellable at any time by the Board of Trade, must be posted in a conspicuous position in the ship to which it applies. The carrying of passengers on more than one deck below the water-line is prohibited.

Freightage.—On arrangement of terms of shipment, and the delivery of goods to a ship, a mate's receipt is given for them, and, except in short coasting trips, this is exchanged for bills of lading, which are filled up by the shipper (i.e. the person dispatching the goods) with particulars of his shipment, number of packages, and marks. This is checked on behalf of the ship, and signed by the master or ship's agent. Bills are usually issued in sets of three or four, 'one of which being accomplished the others to stand void'. The shipper keeps all the bills except one, which is in possession of the master. In such cases as an 'Act of God' or 'King's Enemies', the shipowner is absolved from all or any liability in respect of the goods carried. Carriage by charter-party is made where the whole or chief part of a ship is engaged, and sometimes this involves the demise of the ship (i.e. surrender by the owner to the charterer, who will assume control, master and seamen becoming his servants). In all cases owners are (through their masters) responsible for stowage, for the provision of the necessary loading-tackle, and for the protection of goods when on board. During hostilities masters must sail under convoy, and, in the absence of any contrary provision, the voyage must be by the shortest and safest route, all deviation, except for the purpose of saving life, being considered a wrong. On arrival at the port of discharge the master (for the owner) delivers the goods to the person who presents the bill of lading, but he is not bound to notify the ship's arrival to the consignee or charterer, and the mode of discharge is usually subject to the practice of the port. By British law, where the voyage is only partially accomplished, freight is only payable *pro rata* if such agreement has been made or can be implied, but underwriters have the right to freight where a ship has been abandoned. See *Affreightment*; *Salvage.*

Twelve Biggest Ships.—Arranged in order, these are: (1) *Majestic* (former *Bismarck*), British-owned (White Star), quadruple-screw-turbine, 26 knots speed, 56,551 tons gross; (2) *Leviathan* (former *Vaterland*), U.S. Shipping Board, quadruple-screw-turbine, 21 knots speed, 54,282 tons gross; (3) *Berengaria* (former *Imperator*), British-owned (Cunard), quadruple-screw-turbine, 23½ knots speed, 52,700 tons gross; (4) *Olympic**, British-owned (White Star), triple-screw-turbine, 23 knots, 46,440 tons gross; (5) *Aquitania**, British-owned (Cunard), quadruple-screw-turbine, 24½ knots, 45,650 tons gross; (6) *Homeric*, British-owned (White Star), twin-screw, 18½ knots, 34,693 tons gross; (7) *Paris*, French-owned (C^{ie} G^{le} Transatlantique), quadruple-screw-turbine, 22 knots, 34,560 tons gross; (8) *Mauretania*, British-owned (Cunard), quadruple-screw-turbine, 27 knots, 30,696 tons gross; (9) *Empress of Scotland* (former *Kaiserin Auguste Victoria*), British-owned (C. P. Ocean Services), twin-screw, 17½ knots, 25,040 tons gross; (10) *Caracciolo*, Italian-owned (Nav. Generale Italiana), twin-screw-turbine, 18 knots, 25,000 tons gross; (11) *Belgic*, British-owned (International Navigation Company), triple-screw-turbine, 18½ knots, 24,547 tons gross; (12) *Adriatic*, British-owned (White Star), twin-screw, 18 knots, 24,541 tons gross. (See *Mercantile Marine.*) The asterisk (*) denotes those ships fitted for oil fuel. The time for the transatlantic passage has been gradually reduced, but all records were broken by the *Mauretania* in 1909, when she completed the passage from Queenstown (now Cobh) in four days, ten hours, forty-one minutes.

Merchant Shipping Acts, consolidating Statute passed in 1894, and amending Statutes of 1897, 1898, 1900, 1906, 1907, 1911 (Maritime Convention Act), 1913 (Pilotage Act), 1914, and 1921, constitute a voluminous code of sea-law. The Act of 1894 alone extends to 748 sections and 20 schedules, and, accordingly, we can only indicate here the main subjects dealt with. These are the registration, transfer, sale, mortgage, change of name, measurement, tonnage, national character, and flag of ships; general liability of owners; qualifications of officers; supply, engagement, rating, discharge, pay, food, health, protection, and discipline of seamen; equipment and survey of passenger and emigrant ships, and medical inspection, provisioning, &c., of the latter; fishing-boats and crews; prevention of collisions; life-saving appliances; overloading; carriage of dangerous goods, &c.; unseaworthy ships; wrecks and salvage; injury to persons and goods; licensing, qualification, dismissal, and suspension of pilots; lighthouses; &c. These sufficiently indicate the nature and scope of the Acts.

Load-line.—By the Merchant Shipping Act, 1894 (referred to overleaf), and amending Acts, what is generally known as the *Plimsoll mark* (after Samuel Plimsoll, q.v.) was definitely instituted, the main object being the prevention of the overloading of ships. The 'mark' comprises a circular disc 12 inches in diameter, with a straight line 18 inches in length drawn through its centre, the upper edge of the straight line representing the maximum summer load-line. The disc is marked amidships on both sides of the ship, and its centre is specified in the Board of Trade certificate of approval. Connected with the disc, the lines shown in the accompanying diagram indicate the maximum load-line for different seasons and circumstances. They also are marked on both sides of the ship. Each line is 9 inches long and 1 inch thick, and is projected *forward* at right angles to a vertical line drawn 21 inches forward of the disc centre. The fresh-water (FW) mark, however, is projected abaft the vertical line. Limits of navigation (abridged) are as follows: (1) Indian Summer (IS), fine season in Indian Seas between limits of Suez and Singapore; (2) Summer (S), limit from European and Mediterranean ports (not IS voyages) between April and September (both inclusive); (3) Winter (W), limits from European and Mediterranean ports between October and March (both inclusive); (4) Winter North Atlantic (WNA), limits from European or Mediterranean ports to British North America ports or Eastern United States ports north of Cape Hatteras (and the opposite journey) between October and March (both inclusive). The disc and load-lines must be painted white or yellow on a dark ground, or black on a light ground, and the disc and line positions must be permanently indicated by central punchmarks (or by sinking for their breadths into the planking of wooden ships).



Load-line marks, starboard side of a steamer. The arrow shows the direction of the ship's head.

Ship Propulsion. When the steam-engine was made a practical and useful servant of man by the greatest of all inventors, James Watt, the problem presenting itself to those interested in navigation was how to adapt it to the systems of ship propulsion already in use. Paddle-wheels had been suggested in place of oars, and used to a certain extent from the time of the Romans. Lyttleton introduced the screw-propeller (q.v.) in 1794.

To Henry Bell we owe the first actual application of the steam-engine to a ship. Colonel Fulton is also deserving of credit for his early work. From these small beginnings the marine engine was continuously improved in design and reliability, and later, when investigations showed the advantages of compound and triple expansion, these revolutionary changes accelerated the development of marine transport. Its sturdy characteristics were still retained throughout all the changes in practice, and gave the marine steam-engine its position as one of the most reliable types of prime mover. The reciprocating multi-cylinder steam-engine still has a large field of service, but its sphere has been considerably reduced by the introduction of the steam turbine (see *Turbine, Steam*) by the Hon. C. A. Parsons, and later by the production of reliable helical gear for the reduction of the high speeds of efficient running of the turbines to the low speeds of effective working of the propellers. Internal-combustion engines have entered this field, and their use in certain types of vessels has been attended with considerable economy and success. This application has now an extensive use, and its sphere of service is growing. Efficient Diesel engines, working on the four-stroke and two-stroke cycles, and semi-Diesel engines are standard articles of manufacture, and have proved economical and reliable at sea.

Other attempts to transmit power at suitable turning speeds for the propeller have been made besides the use of gearing. These include the electrical systems introduced by H. A. Mavor of Glasgow and W. P. Durtnall. The Mavor experimental boat *Electric Arc* was the first craft worked on this system, and was used in an extensive series of trials on the Clyde in 1911. Many American ships of war are now provided with the electrical transmission plant. Power transmission by hydraulic pressures, and also by oil-pumps and motors, has been introduced and successfully applied.

Ships, Registration of. See *Shipping.*

Shipton, Mother, a celebrated prophetess in popular English tradition, probably a mythical personage, though she is said to have been born near Knaresborough in 1488, and to have died in 1561, having married a carpenter called Toby Shipton. A book published in 1641, with the title *The Prophecie of Mother Shipton in the Raigne of King Henry 8th,* ascribes to her a prediction of the death of Cardinal Wolsey and other eminent persons, and various prophecies were subsequently attributed to her, some in 1879 and 1881, when they raised a panic in superstitious rural districts.

Ship-worm (*Terēdo navālis*), the popular name of a bivalve mollusc belonging to the family Teredinidæ, closely related to the Pholadidæ or pholas family, and distinguished by the elongation of the respiratory 'siphons' or breathing-tubes conveying water to the gills, which give to this mollusc a somewhat vermiform or wormlike aspect. The two valves or halves of the shell are of small size and globular shape, and are situated at its anterior extremity, the valves being three-lobed. In length the ship-worm averages about 1 foot, and in thickness about ½ inch. It has gained notoriety from its boring habits, which cause great destruction to wooden ships. In boring into the wood (the shell is the boring instrument) each individual is careful to avoid the tube formed by its neighbour, and often a very thin film alone of wood is left between the cavities, which are lined with a calcareous encrustation. A large species of Teredo (*T. gigantea*) occurs in warm latitudes, where it bores into the hardened mud or sand of the seabed, as well as into timber.

Shiraz′, a city of Persia, capital of the province of Farsistan. Founded about the beginning of the eighth century, it was long one of the most splendid cities of Persia. It lost much of its importance after being conquered by Tamerlane in the end of the fourteenth century. At present it is known chiefly for its wines and its inlaid work. Near the city are the tombs of the native poets Sadi and Hafiz. In 1911 Shiraz was occupied by British troops, which were, however, soon withdrawn. In 1915 a revolt broke out in the city, and the British Consul was imprisoned, but order was restored (1916) by Sir Percy Sykes. Pop. 50,000.

Shire. The division of England into shires dates from very early times, and with regard to the south, it would be more accurate to say that the shires coalesced into a kingdom than that the kingdom was divided into shires, for Sussex, Surrey, Kent, Middlesex, and Essex are the representatives of what were once independent states, and it is probable that Hampshire, Berkshire, Wiltshire, Dorset, Devon, and Somerset are also relics of semi-independent settlements. The midland shires are generally regarded as originating in the time of the reconquest of the Danelaw; the English inhabitants of a district were placed under the protection of a garrisoned fort, and such shires as Oxford, Gloucester, Buckingham, Warwick, Leicester, &c., take their name from the county town which was the centre of their defensive organization. The shires north of the Humber were later in date, and were deliberately formed as units of administration. Over each shire was placed a shire-reeve or sheriff (q.v.). The system of shire administration which existed in Anglo-Saxon times was retained after the Norman Conquest, but the introduction of itinerant judges by Henry I and Henry II reduced the importance of the sheriff. While the central authority was thus increased, the power of the sheriff in the local administration of justice was diminished by the creation of justices of the peace in the fourteenth century, and by Tudor times these officers had acquired very large powers. The military authority of the sheriff was greatly reduced, in the reign of Henry VIII, by the appointment of lords-lieutenant, who, until 1871, performed the military duties which had belonged to the sheriff. The shire was also taken as the unit for parliamentary representation. The shire organization remains to the present day, each shire possessing its lord-lieutenant, sheriff, and justices of the peace, along with such necessary officials as a coroner, a *Custos Rotulorum* or keeper of the records, and clerks of the peace. The Local Government Act of 1888 transferred to county councils some of the duties that had belonged to justices of the peace, and also conferred upon them new powers of local administration.

In Scotland the division into shires originated in the twelfth century, and was part of the process of anglicization conducted by the dynasty of Malcolm Canmore. Many of the shires represented older administrative organizations, but the process of their creation is obscure, and was not completed until the seventeenth century. Until the abolition of hereditary jurisdictions in 1746, many of the Scottish shires were under hereditary sheriffs, who showed a tendency to independence and exercised their offices through deputies. The shire was also the unit for parliamentary representation in Scotland, but its importance in this respect has been diminished by the arrangements made in the Redistribution Act of 1918. Justices of the peace were introduced into Scottish shires by James VI, but the office did not take root until after the Union. Lords-lieutenant were not appointed for Scottish shires until 1794. In Ireland the creation of shires began in the reign of John and was completed in that of James I. A division into counties has also been artificially made in the United States of America.

Shiré (shē′rā), a river of Nyasaland Protectorate and Portuguese East Africa, the southern outlet of Lake Nyasa, an affluent of the Zambezi, which it enters on its left bank, after a course of about 270 miles nearly due south. On its banks are Fort Johnston, Port Herald, and Chindio.

Shirley, James, English dramatist and poet, was born in 1596, and died in 1666. He was educated at Merchant Taylors' School, St. John's College, Oxford, and Catharine Hall, Cambridge. He took holy orders in the Church of England, but soon afterwards joined the Church of Rome and became a schoolmaster. In 1625 he commenced his prolific career as playwright, and between that date and the closing of the theatres in 1642 he wrote entirely or in part upwards of thirty plays. The best of his tragedies are *The Traitor*, *The Maid's Revenge* and *The Cardinal*; of his comedies *Hyde Park*, *The Gamester*, and *The Witty Fair One* are the best known. In 1634 Shirley was chosen to write the great masque, *The Triumph of Peace*, which the four inns of court presented to the king and queen. During the Commonwealth Shirley devoted himself to the composition of Latin grammars. After the Restoration several of Shirley's plays were revived, but he did not write any new ones. He died as a result of the Great Fire, being "overcome with affrightments, disconsolations, and other miseries". He appears to have been a man of a modest and amiable disposition, and to have been popular among his fellow-dramatists.

Shirley is important not so much on his own account as because he was the last of 'the giant race before the flood'. His plays run on familiar lines, and are without violence or exaggeration. He is a more equal writer than Ford or Massinger, though he does not rise to the heights which they sometimes attain. As a poet Shirley is best remembered for his lyric "The Glories of our Blood and State".

Shirwa, or **Tamandua**, a lake of Central Africa, in the mountainous district south-east of Lake Nyasa. It has shrunk to a swamp through excessive evaporation.

Shi'shak, King of Egypt, mentioned by the Hebrew writers, the Shashanq I of the monuments, and the first sovereign of the Bubastite (twenty-second) dynasty, established about 945 B.C. A sculpture at the temple of Karnak gives a list of 180 towns and peoples conquered by Shishak.

During the Middle Empire (11th–12th dynasties) and the Late Empire (18th–19th dynasties), the Libyans were tributary to Egypt; but they eventually became so powerful as to attempt the conquest, by force of arms, of the Egyptian Empire, and were only with difficulty suppressed, after suffering severe defeats at the hands of Meremptah and Rameses III. They continued to pour into the Nile Delta, however, as immigrants, and this Shishak (Shashanq I) was a lineal descendant of one Buiuuaua, a Libyan prince or chieftain, who flourished B.C. 1151 and was general of Libyan mercenaries in the service of Egypt. The descendant of this prince, in the fourth generation, was one, Shashanq, whose son Nemareth was Shashanq's father. Nemareth's mother was Mehtenusekht, high priestess of Amen, and princess of the twenty-first (Tanite) dynasty. Shashanq I was the conqueror of Palestine. See *1 Kings*, xi, 40; *1 Kings*, xiv, 25-6; *2 Chron.* xii, 2–5, 7, 9.

Shoa, a district of north-central Abyssinia, formerly an independent kingdom; area, 26,000 sq. miles. It consists mostly of plateaux attaining an altitude of 10,000 feet on the south-east and south, but overtopped by higher mountains, and intersected by tributaries of the Blue Nile. The capital is Addis Abbaba.

Shock, in medicine, a sudden vital depression of the system produced by violent injuries or violent mental emotions. The vital phenomena of the body—consciousness, respiration, heart action, capillary circulation—are depressed in proportion to the shock received by the nerve-centres. In the state of collapse consequent upon shock the patient lies completely prostrate, the face pale and bloodless, the skin cold and clammy, and the features contracted and expressive of great languor. There is also extreme muscular debility, and the pulse is frequently so weak as scarcely to be perceptible. Shock either results in a complete suspension of the action of the heart, causing death, or passes into reaction; and the treatment of shock is to be directed to the immediate development of reaction. In mild cases external warmth, the exhibition of some aromatic stimulant to the nostrils, such as ammonia or smelling-salts, and rest are all that is required; alcohol is not often desirable. In the severer forms a more elaborate treatment is adopted. To raise the temperature of the air surrounding the body various devices, hot flannels applied to the abdomen, hot-water bottles, or an arrangement of electric lamps in a cage, are called into requisition; while, further to combat the results of shock, injection of hot saline fluids into the body by various methods is practised with success. Enemata of hot, strong coffee have been found of great value. Surgical shock is a variety of shock sustained in spite of the abolition of consciousness by anæsthetics. Crile of New York has devised a valuable preventive technique.

Shoddy, the fibrous substance composed of disentangled fibres from loose woollen garments, such as stockings, light shawls, loosely woven woollen cloths, and unmilled fabrics generally. It is 'blended' in various proportions, either with new wool, wool and cotton, wool and mungo, or with all these fibrous substances. The towns of Batley, Dewsbury, Ossett, and Heckmondwike are the chief seats of the shoddy and mungo trade. This area is termed the 'heavy woollen district'.

Shoebill, or **Shoebird**, a wading bird of the Sudan, the only species of the genus Balæniceps (q.v.).

Shoeburyness, an urban district of England, in the county of Essex, on the Thames estuary opposite Sheerness. There is a gunnery school at which heavy ordnance is used experimentally. Pop. (1921), 6400.

Shoes, coverings for the feet, generally made of leather but often of wood, and in China and Japan of paper and other fabrics. Shoes proper, as well as sandals, seem to have been used amongst the Jews. The Romans used various kinds of shoes, such as the *solea* or sandal;

the *calceus*, which covered the whole foot, somewhat like our shoes, and was tied with a latchet or lace; and the *caliga*, a very strong kind of shoe, sometimes shod with nails, worn by the soldiers, who were thence called *caligati*. In the reigns of Henry I and Stephen shoes were made for the fashionable with long points stuffed with tow, and made to curl in the form of a ram's horn; and in the reign of Richard II the points had increased to such an extent that they reached the knee, to which they were secured by chains of silver or gold. In the eighteenth century, among the ladies, high-heeled shoes were the rage. The present simple form was adopted in the early part of the seventeenth century, and somewhat later the shoe buckle came into use. In the early part of the nineteenth century buckles were superseded by shoe-laces. To the same period belongs another improvement, that of making shoes right and left.

Sholapur′, a district and city of India, in the central division of the Bombay Presidency. The city is the head-quarters of the district. Area, 4540 sq. miles; pop. (district), 768,000; (city), 61,345 (mainly Hindus).

Shoebill

Shops Acts, statutes regulating the hours and conditions of employment of shop assistants. From the year 1893 onwards several Acts were passed, and these are now consolidated in the Shops Act of 1912, itself later amended. By that Act no person under eighteen years of age can be employed in or about a shop for a longer period than seventy-four hours (including meal-times) in one week, and on at least one business day in each week every shop assistant must receive a half-holiday, and on such a day must not be employed about the business of the shop after 1.30 p.m. Provision is also made for the closing of shops for the serving of customers not later than 1 p.m. on one weekday in every week, and protection is afforded to shopkeepers against others carrying on any similar business elsewhere than in a shop during such close periods. Exemption from this obligation may be granted by the local authority during the busy season in holiday-resorts, and the obligation does not extend compulsorily to shops for the sale of refreshments, newspapers, tobacco, articles of a perishable nature, medicines, &c. Generally, no assistant must be employed for a longer period than six hours without an interval of at least twenty minutes during that period; and where the hours of employment include the hours between 11.30 a.m. and 2.30 p.m. at least forty-five minutes between those hours must be allowed for dinner, and where they include the hours between 4 p.m. and 7 p.m. at least thirty minutes between those hours must be allowed for tea, the former interval being increased to one hour if the meal is not taken on the premises. The Act also made provision for the fixing of the hours in the evening at which shops should be closed for the serving of customers. An order for this purpose may be made by the local authority and confirmed by the Home Secretary (in Scotland, the Secretary for Scotland). An Act of 1913 made special provisions for places of refreshment. In all rooms of a shop where female assistants are employed for serving customers, seats must be provided in the proportion of not less than one seat to every three such assistants employed in each room.

Shore, Jane, the wife of a rich goldsmith of London in the fifteenth century, and mistress of Edward IV. After the death of Edward, in 1483, she was accused by Richard III of sorcery, and was obliged to do public penance at St. Paul's.

Shoreditch, a north-eastern metropolitan borough of the county of London. The name is derived from a great common sewer or ditch that once traversed the borough, which stood on the Roman road from London Wall to the ford at Hackney. Shakespeare is supposed to have been connected with The Theatre (built in 1576, demolished 1599) and The Curtain (built 1577, demolished 1772), two local theatres, and this connection is commemorated by a window in the parish church of St. James.

Shoreham, a seaport-town and watering-place of England, in the county of Sussex, at the mouth of the Adur. The parish church dates from about 1100. A Canadian convalescent camp and an aerodrome were located at Shoreham during the European War. Pop. (1921), 7800.

Shorthand. Any method of writing briefer than that which preceded it may, in a sense, be termed shorthand. The hieroglyphics and ideographs used in ancient Egypt were an advance upon the earlier crude picture-writing, while the transition from hieroglyphics to alphabetic writing was at once a stupendous revolution and an enormous step forward in the direction of progress, alike as to swiftness and definiteness of expression.

But shorthand is commonly understood to mean a system of more or less rapid writing by means of signs or characters briefer than those used in the ordinary writing of the time. Mention is made by ancient Greek and Roman writers of an abbreviated mode of writing, variously attributed to Ennius (about 150 B.C.), to Mæcenas, and to Cicero, although the prevailing opinion now is that the invention or development was the work of Tiro, the freedman of Cicero. This method of writing (which had some of the characteristics of modern shorthand) was improved by Seneca and other writers, and, according to Plutarch, it was by its means that the oration of Cato, relative to the Catilinarian conspiracy, was preserved. That the system was inferior to our modern shorthand may be inferred from the fact that this early reporting feat was achieved not by a single scribe, but by " a number of the swiftest writers, placed in different parts of the Senate ", who pooled their several 'takes', and so built up a comparatively full record of the great speech. From the decline of the Roman Empire in the fifth century till the invention of printing and the revival of learning in the fifteenth century there is little or no trace of shorthand.

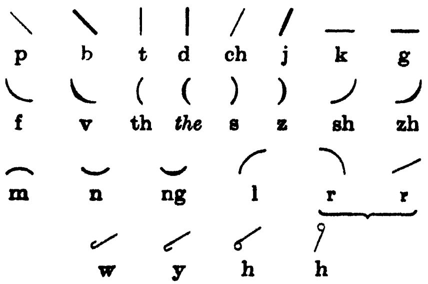
England is pre-eminently the home of shorthand, and since Dr. Timothy Bright dedicated his stenographic system called 'characterie' to Queen Elizabeth, a very great number of systems (original, adapted, pirated, or 'improved') have appeared. Circumstantial evidence favours the idea that the quarto of Shakespeare's *Hamlet* (1603) was produced from shorthand notes. Chief among the pre-Pitman systems of shorthand are Byrom's (1742), the work of a man of learning and ability who had a good idea of what a shorthand system should be; the Gurney system, founded on Mason's, the best of the seventeenth-century systems; Angell's, mentioned in Boswell's *Life of Johnson*; Samuel Taylor's (1786); and Harding's (an adaptation of Taylor's), which Isaac Pitman learned and used before he invented his own famous 'phonography', first issued in 1837 under the title *Stenographic Sound-hand*.

Among the shorthand inventors who have produced systems since 1837 are: Sir Edward Clarke, the well-known lawyer (two systems, 1907, 1916); and Alexander Melville Bell, father of A. Graham Bell, the inventor of the telephone. Mr. Bell's system was a phonetic one, which provided for the representation of some niceties of speech, which experience has shown to be unnecessary, and his system had few of the facile time-saving expedients that abound in the Pitman system. It is not surprising, therefore, that, though it found a place in some of the encyclopædias and educators of the time, Pitman's shorthand was substituted for it later on. Between Script (Malone's, 1886) and Light-line (Gregg's, 1888) there is some general resemblance, since in both systems joined vowels are used to a limited extent, and certain useful alphabetic characters are rejected in order that the writing may be in the same slope as longhand. The Sloan-Duployan system is an adaptation of a system which is popular in France.

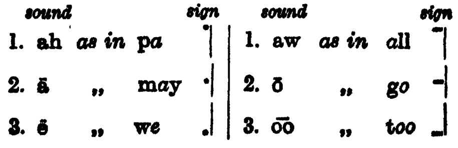
Isaac Pitman's Shorthand.—Isaac Pitman was not the first to analyse and classify the sounds of English speech. Walker had already attempted this in his *Pronouncing Dictionary*, but Pitman was the first to devise a brief and legible system of writing based upon a philosophical theory of the sounds of the language, whereby each simple symbol represents a definite sound (and no other) with the same certainty as that with which figures are used to denote numbers. The Pitman phonetic alphabet, it will be seen, makes good the deficiencies of the ordinary A B C alphabet by providing twenty-four consonants and the twelve vowels which, at the least, are required for an adequate representation of our language.

Alphabet of Pitman's Phonography

CONSONANTS

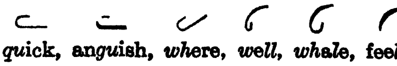


VOWELS

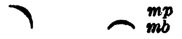


sound			sign	sound			sign
1. ah	*as in*	pa		1. aw	*as in*	*all*	
2. ā	„	*may*		2. ō	„	*go*	
3. ē	„	*we*		3. o͞o	„	*too*	

In addition to these six long vowels, there are six short ones, heard in the words: *That pen is not much good.* These are written by similar, but lighter, dots and dashes in the same positions as their corresponding long vowels, the places of which are: *ah* and *aw* at the beginning of a consonant (before or after), ă and ŏ at the middle, and ĕ and ŏŏ at the end. There are also four diphthongs: ˅ as in *I, eye,* ˺ as in *oil,* ∧ as in *now,* and ∩ as in *you.* Eight compound consonants are provided:



as in *qu*ick, an*gu*ish, *wh*ere, *w*e*ll*, *wh*a*l*e, fee*ler*,

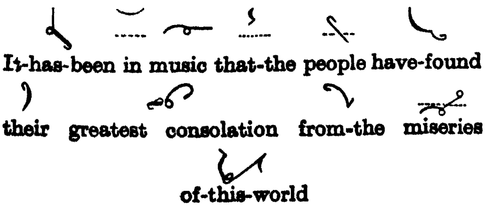


poo*rer*, *emb*ankment.

Space does not allow even of a summary of the development of the system being given here. Suffice it to say that this alphabet provides each of the clearly recognizable sounds of spoken English with a symbol at once distinct, definitive, unmistakable; a sign certain as to its sound value and capable of being easily written and easily read. But it is not only in its alphabet that the Pitman system excels. It is logically developed with rare knowledge and ingenuity, so that all the available material—strokes (straight and curved), dots, dashes, circles and loops (large and small), hooks, half-lengths, double-lengths, and light and heavy characters are all wisely allocated to the best purposes in accordance with the genius—the peculiar characteristics—of our language. It is in this matter of up-building, no less than in its scientific and thoroughly practical alphabet, that the system stands pre-eminent.

From a glance at the alphabet and the line given below in the brief reporting style, it will be seen that, as a word is heard the consonants (forming the skeleton of it, so to speak) are written, any necessary vowels being added. In practice it is found that, in the case of the Pitman system, which in its development makes large provision for *indicating* the place of occurrence of a vowel, the consonantal outlines are so expressive that only in about 5 per cent of words is it necessary to insert a vowel. In the sentence here illustrated not a single vowel is required:

Specimen in Brief Reporting Style


It-has-been in music that-the people have-found
their greatest consolation from-the miseries
of-this-world

The system is peculiarly rich in abbreviating devices, by means of which, in many cases, whole groups or clusters of consonants, and indeed whole words and phrases, can be written by a few facile pen movements so brief as to effect, without loss of legibility, extraordinary economy in writing. Liberal use is made of *phraseography,* the writing of several logically related words without lifting the pen. To this the system readily lends itself. It is noteworthy that well-conceived phrase-forms not only promote the speed of writing, but also increase legibility. Many of them are so facile and expressive that they excite admiration.

To a considerable extent the presence of a vowel is indicated either by the *position* of the outline with reference to the line, or by the consonantal form itself. A number of words (mostly short) of very frequent occurrence are represented by extremely simple signs. They are called *logograms,* or word-letters, because they consist of no more than a single alphabetical stroke, with or without a hook, circle, or loop; the shorthand *b,* for instance, representing *be; bn = been; m = me; mst = most,* and so on. Rules are given for writing many other words of common occurrence by contracted forms, while prefixes, suffixes, and terminations are well provided for.

Although the alphabet has not undergone any considerable modification since 1840, the system as a whole has been constantly improved between that time and the present, and it has now attained to a high degree of perfection.

More than a hundred systems of shorthand have appeared in Great Britain alone since Pitman's was published in 1837, yet the Pitman system continues to hold a strongly predominant position, not only in this country but throughout the whole English-speaking world, and by means of it is performed the great bulk of stenographic work in Parliament and the Senate, on the press, in business and commercial offices, and, in short, in every sphere of activity which demands the employment of this time-saving art.—Bibliography: T. A. Reed, *The Shorthand Writer;* I. Pitman, *History of Shorthand; Pitman's Shorthand Instructor.*

Shorthouse, Joseph Henry, British novelist, born in 1834, died in 1903. His reputation rests upon one book, *John Inglesant* (1881), a romance of the Stewart period, which excited much interest on its appearance. Among his other works are: *Sir Percival, a Story of the Past and Present;* and *Blanche, Lady Falaise.*

Shoshones, or **Snakes,** a tribe of North American Indians inhabiting a stretch of territory in Idaho, Wyoming, and Nevada. They number about 4000.

Shotts, a parish and village of Scotland, in the county of Lanarkshire. The parish contains the villages of Harthill, Dykehead, Cleland, &c. The Shotts ironworks are world-famous, and the adjacent coal and iron deposits are extensive. Pop. 21,000.

Shoulder-joint, the articulation of the upper arm or humerus with the glenoid cavity of the scapula or shoulder-blade. (See *Arm.*) The shoulder-joint forms an example of the ball-and-socket joints, the ball-like or rounded head of the humerus working in the shallow cup of the glenoid cavity. Such a form of joint necessarily allows of very considerable movement, while the joint itself is guarded against dislocation or displacement by the strong ligaments surrounding it, as well as by the tendons of its investing and other muscles. The muscles which are related to the shoulder-joint are the *supraspinatus* above, the long head of the *triceps* below, the *subscapularis* internally, the *infraspinatus* and *teres minor* externally, and the long tendon of the *biceps*. The *deltoid* muscle lies on the external aspect of the joint, and covers it on its outer side in front, and behind as well, being the most important of the muscles connected with it. The biceps muscle, from its connection with both elbow- and shoulder-joints, brings the movements of both into harmonious relation. The shoulder-joint is liable to various diseases and injuries. Local injury may result in inflammation of the joint, whilst special diatheses or diseased conditions of constitutional origin may each give rise, either *per se* or through injuries, to such lesions as strumous or scrofulous disease of the joint, to syphilitic lesions, and to gouty or rheumatic attacks. Of the accidents to which the joint is liable *dislocations* are by far the most frequent.

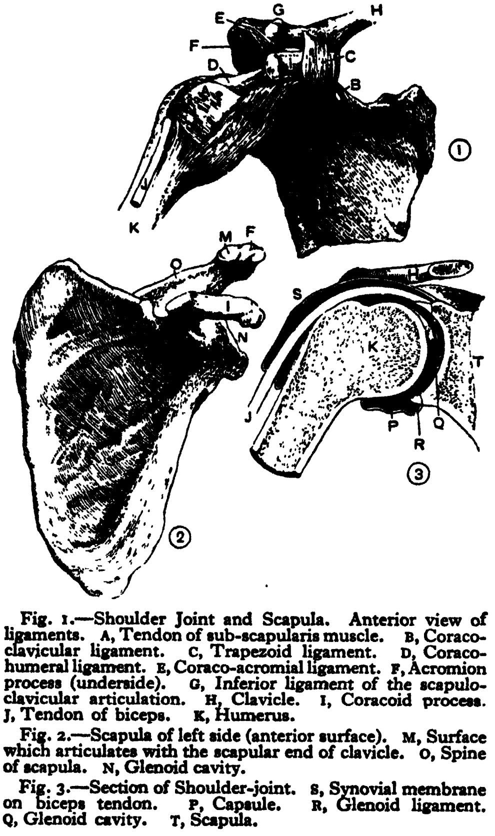


Fig. 1.—Shoulder Joint and Scapula. Anterior view of ligaments. A, Tendon of sub-scapularis muscle. B, Coraco-clavicular ligament. C, Trapezoid ligament. D, Coraco-humeral ligament. E, Coraco-acromial ligament. F, Acromion process (underside). G, Inferior ligament of the scapulo-clavicular articulation. H, Clavicle. I, Coracoid process. J, Tendon of biceps. K, Humerus.

Fig. 2.—Scapula of left side (anterior surface). M, Surface which articulates with the scapular end of clavicle. O, Spine of scapula. N, Glenoid cavity.

Fig. 3.—Section of Shoulder-joint. S, Synovial membrane on biceps tendon. P, Capsule. R, Glenoid ligament. Q, Glenoid cavity. T, Scapula.

Shovel, Sir Cloudesley, British sailor, born in 1650, died in 1707. He distinguished himself at Beechey Head (1690), La Hogue (1692), and Malaga (1704), and in 1705 succeeded Sir George Rooke as commander-in-chief of the British fleets. He took part in the capture of Barcelona (1705), and in the unsuccessful attempt upon Toulon (1707). When returning home with the fleet (22nd Oct., 1707), he was wrecked on the rocks near Scilly, and of the 800 men on board his ship, *The Association*, not a soul was saved. His body was washed ashore next day, and buried in Westminster Abbey.

Shovel-fish (Scaphirhynchus), a genus of fishes belonging to the Acipenseridæ or sturgeon family, so named from the flattened form of the snout. There are four species, one native to the Mississippi and the other three to Chinese rivers.

Shoveller-duck (*Spatŭla clypeāta*), a genus of ducks, distinguished by the long bill, of which the tip is hooked and broadened. The average length is about 18 or 20 inches. In the male the colours are gay and varied. The shoveller-duck is widely distributed, and is found in Britain during the winter.

Shreveport, a city of Louisiana, United States, on the Red River. It is the shipping centre for a large cotton-raising region, has a trade in live-stock and cattle, and has miscellaneous manufactures. It was settled in 1836, and became a city in 1871. Pop. 48,900.

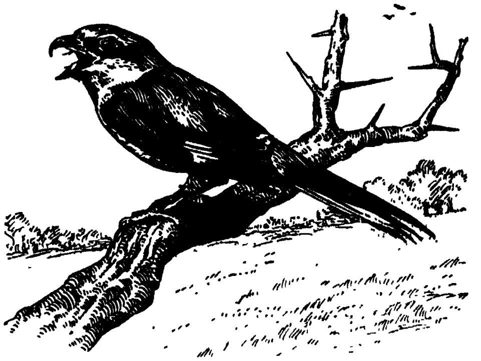
Shrew, or **Shrew-mouse**, the name of small mammals belonging to the order Insectivora, and to be carefully distinguished from common mice (Muridæ) and dormice (Myoxidæ) of the Rodent order. The shrews form the family Soricidæ, and the genus Sorex includes the typical members, two of which are found in Britain, namely, the common shrew and the lesser shrew, and extend eastwards through Europe and Asia north of the Himálaya. The common shrew (*S. vulgāris*) averages about 4 inches in length, and may readily be distinguished by its prolonged muzzle, by the teeth being coloured brown at the tips, and by the reddish-brown fur. It feeds upon insects and larvæ, and mostly inhabits dry places. Its habits are chiefly nocturnal. Shrews are very voracious, and frequently kill and devour one another. They are not eaten by other animals. Their bodies were at one time thought to have healing properties. The lesser shrew (*S. minutus*), the smallest British mammal, is rare in England and Scotland, but is comparatively common in Ireland, where the common shrew is not found. The closely related water shrew (*Crossopus fodiens*) attains a total length of from 4½ to 5 inches. The snout is not so pointed as that of the common shrew. The ears are very small. The colour is black on the upper and white on the under parts. A prominent swimming fringe of stiff white hairs is found on the tail and on the toes. It makes its burrows in the overhanging banks of rivers and lakes, and dives and swims with great facility. It is not found in Ireland, and is rare in Scotland, but is generally distributed throughout England. The red-toothed shrews characteristic of the North American continent are distinguished from Sorex by the dentition and the remarkable shortness of the tail. In the aquatic genus Chimarrogale—represented in the Himálayas, Borneo, and Japan—the tail is fringed, but the feet are not webbed. The web-footed *Nectogale elegans* lives in the rivers of Tibet.

The tree shrews or squirrel shrews of Asia belong to the genus Tupaia. In appearance and habits they closely resemble squirrels. They have long bushy tails, lead an arboreal life, feed on fruit and insects, and when eating, sit on their haunches, holding their food between their fore paws. The jumping shrew, or elephant shrew, ranges over the African continent. The most familiar species are the *Macroscelides proboscideus* of South Africa, and the *M. Rozeti* of Algeria, the latter being called *rat à trompe* by the French. The hind legs of the jumping shrews are much longer than the fore, and, like the jerboas and kangaroos, they are fond of a sitting posture.

Shrew-mole (*Scalops aquaticus*), a genus of insectivorous mammals, belonging to the Talpidæ or mole family. It is found in North America, usually near rivers and streams.

Shrewsbury, a municipal borough of England, the county town of Shropshire, on the Severn. Shrewsbury School, a famous public school, was founded in 1551, and moved to a new building in 1882. It has nine houses, and about four hundred boys. Manufactures include: glass-staining, agricultural implements, iron-founding, tobacco, tanning, malting, and brewing. Pop. (1921), 31,000.

Shrike, a general name applied to the members of a family (Laniidæ) of perching birds. The type-genus Lanius is distinguished by the broad base of the bill, which is hooked at the tip. The nostrils, which are situated laterally, are surrounded by bristles. The great grey shrike (*L. excubitor*) makes its appearance in Britain during the winter. This species is coloured grey on the upper and white on the under parts, the quills of the tail being black with white tips, whilst a band of black crosses the forehead. The average length is about 9 or 10 inches. The food consists of mice, shrew-mice, small birds, frogs, and insects; and these birds have the habit of impaling their prey on thorns or suspending it on the branches of trees, in order to tear it to pieces with greater ease, a habit which has obtained for them the name of butcher-birds. The red-backed shrike (*L. collurio*) is a common summer visitant to Britain. Its average length is 6 or 7 inches. The wood-chat shrike (*L. pomeranus*) sometimes appears in Britain. Other types are the piping crows



Great Grey Shrike (*Lanius excubitor*)

Fork-tailed Crested Shrike (*Dicrurus cristatus*)

(Gymnorhina) of Australia and Tasmania, and the helmet bird (*Euryceros prevosti*) of Madagascar. The name of drongos or drongo-shrikes has been given to certain birds allied to the shrikes, and forming the family Dicruridæ.

Shrimp, the name applied to many small crustaceans, and especially to the *Crangon vulgāris* or common shrimp, which belongs to the order Decapoda (ten-footed crustacea) and to the sub-order Macrura (long-tailed). The common shrimp reaches a length of about 2 inches, inhabits the sand of many parts of the British and Irish coasts, and is caught for the market by means of a bag-net placed transversely on a pole, which is pushed through the sand at a depth of about 1½ or 2 feet. When alive it is of a light-brown or almost white colour, resembling that of the sand in which it lives, but after boiling it assumes the well-known brown colour. It is common on the east and west coasts of North America as well as those of Britain. Other British species are the banded shrimp (*C. fasciātus*), Bell's shrimp (*C. sculptus*), and scarlet shrimp (*Alphēus ruber*). The *Pandălus annulicornis*, or red shrimp, inhabits deeper water than the common shrimp, and is not nearly so abundant. It reaches a size of from 2 to 2½ inches. When alive it is of a reddish-grey, with spots of deeper red; after boiling it is of a uniform deep red. This species is sometimes confounded with the common prawn; but it never reaches the size of the prawn. The 'fresh-water shrimp' (*Gammărus pulex*) of streams and brooks belongs to the order Amphipoda.

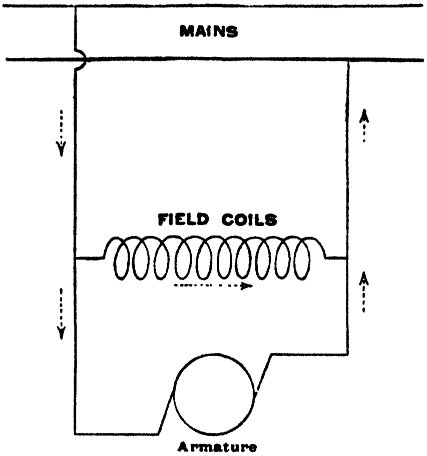
Shropshire, or Salop, an inland county of England, divided into two nearly equal portions by the Severn. The northern portion is generally level; the southern is more hilly. Iron, lead, and other minerals, including large beds of coal, are found. Agriculture is progressive. In the south and west cattle-breeding and dairy-farming are carried on. The county is famous for its breed of sheep. Manufactures include: iron, agricultural implements, chinaware, carpets, paper, and flannel. Area, 1346 sq. miles; pop. (1921), 243,000.—Bibliography: Doubleday and Page, *Shropshire* (*Victoria History of the Counties of England*); J. E. Andan, *Shropshire*.

Shrove-Tuesday, the day before the first day of Lent or Ash-Wednesday, so called as a day on which confession was specially made and 'shrift' received.

Shrubs, plants in which the perennial portion forms the greater part, which branch near the base, and which are taller than bushes but not so tall as trees, seldom exceeding the height of a man. For practical purposes shrubs are divided into the deciduous and evergreen kinds. Among ornamental shrubs the best known are those belonging to the genera Rosa. Ribes, Rhododendron, Azalea, &c. Among evergreen shrubs are the box, the laurel, and various heaths.

Shumen (Turk. *Shumla*), a town of Bulgaria, capital of the district of Shumen (pop. 280,000); served by the State railway to Plevna, and by the Rustchuk-Varna trunk line. It is an important place strategically, as a nodal point of essential roads from Rustchuk, Silistria, the Balkan passes, and Varna; and as a centre of key railways. Silk, tobacco, carpets, leather, and cereals are the chief trade commodities. Pop. 22,000.

Shunt Motor, an electric motor in which the field coils are energized by being connected across the supply mains, thus forming a shunt or by-pass circuit to the main one, which is through the armature. The field coils are made up of a large number of turns of fine wire, the intention of the designer being to provide the required number of ampere-turns for the magnetic circuit with the use of coils of comparatively large resistance, as they are to be connected directly across the supply pressure (see *Electric Motors*).



Shunt Motor: Diagram of Connections

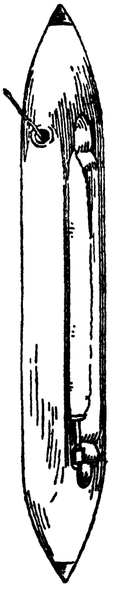
There are considerable difficulties in connection with the design of starting arrangements (see *Rheostat*) for large motors, especially when heavy masses must be set in motion at the moment of starting the machine. In the electrically operated plants for hoisting in mines, one method in use is to employ a battery which is connected across the mains but from various points in which tappings are taken to a battery switch. In this way only a fraction of the total pressure is applied to the armature on starting. The pressure of supply to the armature is gradually increased until the line voltage is operative. Another method of starting large motors is to employ a motor-generator set with a low-excitation current for the generator at the start. The excitation is gradually increased until the motor is brought up to full speed, when it can be switched over to the mains. The use of a heavy flywheel between the auxiliary motor and the generator, which is known as the Ilgner system, acts so as to equalize the load on the station.

Commutator poles are sometimes introduced to get over sparking when the load varies considerably. Their effect is to produce neutral zones for the brushes, which are little disturbed by the armature reactions, however great they may be. Stability coils, consisting of light series windings, are sometimes used with the commutator-pole type of motor for the purpose of ensuring stability under all conditions of working. The use of this device does not change the speed-torque characteristics from those of the shunt-wound motor.

Compound-wound motors, with both series and shunt windings, are occasionally necessary where starting under considerable load and then running at constant speed are the requirements. The series coil has little effect after the starting operations are completed.

The efficiency of a shunt motor rises with the normal load from about 72 per cent for a ½-h.p. motor to 92 or 93 per cent for motors of 100 h.p. and over.

For bibliography, see *Series Motor*.


Shuttle

Shuttle, a long, narrow, and shallow wooden instrument, pointed at both ends with iron, and provided with a recess, termed a well, to hold a pirn or cop of weft. The end of the weft is passed through the eye of the shuttle, and, as the latter is made to travel to and fro between the two layers of warp threads, it leaves a trail of weft yarn each journey.

Sial′idæ, a family of neuropterous insects, with very large anterior wings, which frequent the neighbourhood of water. The alder-fly (*Siălis lutaria*) is a well-known member of this group, being used as a bait by anglers. Its larvæ are aquatic. In the allied snake-flies (Raphidia and Inocellia) the voracious larvæ are terrestrial.

Siam′ (Muang Thaï, i.e. kingdom of the free), an independent kingdom of Indo-China. Area, about 198,900 sq. miles (45,000 in the Malay Peninsula); pop. about 9,200,000. There are seventeen circles (*monthons*), and a special area around Bangkok, the capital. *Physical.*—There are three natural divisions: (1) northern uplands of steep, tree-clad slopes about 8000 feet altitude, which encircle (2) the wide lowlands of the lower Menam River in the west, separated by a low watershed from the middle Mekong basin, which occupies the east; and (3) the Isthmian region of the Malay Peninsula. The humid climate is enervating for Europeans; the wet season lasts from May to October, and in November the cool season begins. *People.*—The Siamese are small in height (average, 5 feet 3 inches), and of light-brown complexion. They are Buddhists by religion. *Education.*—There is a university at Bangkok, opened 1917, with faculties of medicine, political science, literature, engineering, and natural science. A Minister of Public Instruction controls Siamese education generally. *Currency, &c.*—The unit is the silver *tical*, nominally equivalent to 1*s.* 6½*d.* sterling (i.e. 13 *ticals* = £1). Other coins are: (silver) the *salung* = ¼ *tical*, 2-*salung* = ½ *tical*; (nickel) 5-*satang* = $\frac{1}{20}$ *tical*, 10-*satang* = $\frac{1}{10}$ *tical*; (bronze) the *satang* = $\frac{1}{100}$ *tical*. In the north-west the Indian rupee is more or less current. There are no standard weights and measures. *Production, &c.*—There are valuable undeveloped agricultural, forestal, and mineral resources. Rice is the chief product, the principal export, and the staple food of Siam. The northern uplands form the world's chief source of teak. Tin (from Malaya) is the only other Siamese commodity of economic importance; but natural products, such as tobacco, cotton, pepper, sugar, citrus fruits, hides, fish, &c., and minerals, including tungsten, wolfram, zinc, antimony, iron, and coal, are capable of wide future development. Rubies and sapphires are also exported in quantity. During 1920–1 about 79 per cent of all Siamese trade was conducted with the British Empire. Over 80 per cent of the total foreign trade passes through Bangkok. *Communications.*—There is regular steamship connection with Singapore and Hong-kong. Four British lines serve Bangkok regularly, and have as competitors (on a small scale) the Japanese and Norwegians. The Department of State Railways has the following lines completed:

	Completed Km.
Northern line (all normal gauge)	950·5
Southern line..	1301·0
	2251·5 (1407 miles).

Government, &c.—Siam is an hereditary monarchy, but primogeniture does not apply, each sovereign having power to nominate his own successor. Executive power is in the hands of the king, advised by a Cabinet with portfolios of War, Marine, Public Works, Interior, Foreign

Affairs, Local Government, Public Instruction, Justice, and Finance, which are mainly held by the king's blood-relations. In 1895 a Legislative Council was created, which comprises 40 members and meets weekly. It may legislate during any temporary incapacity of the sovereign. Local government is controlled by Lords-Lieutenant within each *monthon*, which is subdivided into provinces (*changwats*), districts (*ampurs*), and communes (*tambons*). *Defence.*—Military service became compulsory in 1903, but the law was revised during 1917, when Siam declared war upon Germany and the Central Powers (22nd July), and every fit man between the ages of twenty-one and twenty-two must serve two years with the colours, and seven years in the first reserve, thereafter with a maximum of two months' actual duty annually. The second reserve period is ten years, and the third five years. The army comprises three army corps of nine divisions; an additional division is independent. There is a flying corps. A small naval force exists, of one light cruiser and several gunboats and miscellaneous craft.

History.—Siam appears to have no place in history prior to A.D. 638, and the credible records go back only to 1350, the date of the foundation of Ayuthia, the old capital. The Portuguese established intercourse with Siam in 1511, but in the seventeenth century were gradually supplanted by the Dutch. English traders were in Siam very early in the seventeenth century, but in consequence of a massacre their factory at Ayuthia was abandoned in 1688. The French were expelled about the same time, and the trade was neglected until 1856, when Sir J. Bowring's treaty again opened up Siam to Europeans. The present king is Rama VI. Much Siamese territory next Cambodia and partly on the west of the Mekong has been acquired by France, and a large area is recognized as under French influence. The territory west of the Menam belongs to the British sphere, and the Malay states of Kelantan, Kedah, and Trengganu were ceded to Britain in 1909. Siam's entry into the European War secured her representation by three delegates at the Versailles Peace Conference. Articles 135–6 and 137 of the Versailles Treaty chiefly affect her interests, and Siam became also a member of the League of Nations.—BIBLIOGRAPHY: W. A. Graham, *Siam: a Handbook of Practical, Commercial, and Political Information*; *Siam* (*Peace Handbooks*, vol. xii, prepared by the Historical Section of the Foreign Office); J. Crosby, *Commercial Reports on Siam* (H.M. Stationery Office).

Siamang (*Siamanga* or *Hylobătes syndactylus*), one of the higher anthropoid or man-like apes. This animal, the largest and one of the best known of the gibbons, inhabits Sumatra. It averages about 3 feet in height, has very long arms, and lives in trees.

Sibbald, Sir Robert, Scottish physician and antiquary, born in 1641, died in 1722. He was one of the founders of the Edinburgh Botanic Gardens, and the author of numerous pamphlets and treatises on medicine, botany, zoology, and Scottish antiquities. He was also first president of the College of Physicians, and Geographer Royal for Scotland.

Sibbal′dia, a genus of dwarf evergreen plants, nat. ord. Rosaceæ, named after Sir Robert Sibbald. *S. procumbens*, a British plant, has trifoliate leaves and heads of small yellowish flowers. It is found on the summits of mountains.

Sibe′ria, a vast geographical division of the Eurasian continent; formerly the name applied to the Russian dominions in Asia. It occupies all North Asia, stretching uninterruptedly eastward from the Ural Mountains to the North Pacific Ocean, and southwards from the Arctic Ocean to the Chinese dominions and Central Asia. It has a total area of 4,831,882 sq. miles, with a pop. of nearly 8,000,000. The division into Western Siberia and Eastern Siberia was at one time officially recognized for administrative purposes, but there is no marked natural boundary between the two regions. Siberia may be considered as a vast inclined plane sloping gradually from the Altai, Sayan, and Yablonoi Mountains on the south to the Arctic Ocean on the north. In the east it is traversed in different directions by several mountain ranges. It is drained chiefly by the Obi (2120 miles), with its great tributary the Irtysh (2520 miles), the Yenisei, and the Lena (3000 miles), all of which pursue a northerly course to the Arctic Ocean; and by the Amur (2700 miles, 2400 of which are navigable), which flows in an easterly and north-easterly direction to the Pacific. The principal lake is Lake Baikal in the south. The chief islands are the New Siberia group in the Arctic Ocean, and the Island of Sakhalin in the Sea of Okhotsk. The coast-line is very extensive, but the Arctic Ocean is ice-bound at least ten months out of the twelve, and the Sea of Okhotsk, on the Pacific, is infested with masses of floating ice and dense fogs. Siberia enjoys a warm summer, but the winter is exceedingly severe. Verkhoyansk is the coldest inhabited place in the world. It has a January mean of −60·7° F., and a July mean of 59·6° F. Generally considered, the climate of Siberia is not unhealthy, but frost-bite and snow-blindness are prevalent, together with that peculiar malady of the sub-polar regions, Arctic hysteria, which not infrequently affects whole villages, but leaves settlers undisturbed. South Siberia is rich agriculturally, and yields wheat, rye, oats, and potatoes; but immense tracts of Siberia are utterly unfit for tillage, more particularly the *tundras* or great stretches of boggy country along the Arctic Ocean. In the west are extensive steppes. Roughly speaking, the northern limit of agriculture is 60° N. lat. Cattle-breeding and bee-keeping are largely pursued, and market-gardening is progressive. Hunting and fishing are also sources of wealth, ermines, sables, and other fur-bearing animals being indigenous. The wild animals include the elk, reindeer, and other deer, bear, wolf, white and blue fox, and lynx. The forests are extensive and valuable. Manufactures and mining are in a backward state, though Siberia has very considerable mineral wealth. There are large deposits of gold, copper, silver, platinum, lead, iron, and coal.

Yermak the Cossack entered Western Siberia in 1580, and made a rapid conquest of the western portion of the country, which he handed over to Ivan the Terrible of Russia. Bands of hunters and adventurers then poured across the Urals, attracted by the furs, and gradually penetrated to the Arctic Ocean and the Pacific. The latest acquisitions by Russia were the Amur territory, and coast regions of Manchuria, ceded by China in 1858 and 1860. Exile to Siberia began soon after the conquest, and the region became a vast penal colony where important political offenders (mainly) were kept under close control, but the great majority of the exiles were simply placed in a particular district and allowed to shift for themselves. The indigenous inhabitants include Buriats, Yakuts, Tungus, Tatars, Kirghiz, and Samoyeds (q.v.). Since the Russian Revolution of 1917 the political status of Siberia has been considerably altered. A Far Eastern Republic has been formed, and this is dealt with under *Russia*; *Vladivostok*, *Transbaikalia*, &c.

Communications.—The great Siberian trunk line was begun in 1891 and finished in 1905, during the Russo-Japanese War. From Irkutsk it is continued by the Transbaikal line to Manchuria, and by the Chinese Eastern Railway.

Sib′yl (Gr. *sibylla*), in Greek and Roman legend, the name of certain women endowed by Apollo with a prophetic spirit. Their number is variously stated, but is generally given as ten. Of these the most celebrated was the Cumæan sibyl (from Cumæ in Campania). She is said to have written in Greek verses the collection of prophecies famous under the name of Sibylline books, and containing the *fata urbis Romæ*, three books of which she sold to Tarquin the Proud. These books were preserved in the temple of Jupiter Capitolinus, and were consulted on occasions of national danger. In 83 B.C. they were destroyed by fire along with the temple. A later collection of Sibylline books seems to have been burned by Stilicho shortly after A.D. 400.

Sibylline Oracles, the name given to a collection of apocalyptic writings, composed by Hellenistic Jews and Christians. They enjoyed a great authority in the Middle Ages. The oracles, purporting to be the work of the sibyls, are written in the Homeric dialect and in hexameters. They were first put in circulation by Alexandrian Jews in the second century B.C., were adopted by the Christians during the first centuries of our era, and, with additions and interpolations, were used for the purpose of diffusing the teaching of the new faith.

Sicilian Vespers, the name given to the massacre of the French in Sicily in 1282. Charles of Anjou had established himself, through the favour of the Pope, in possession of the Two Sicilies. He ruled with great severity, and the oppressed people applied in vain for relief to the Pope. On 30th March, 1282, at the hour of vespers on Easter Monday, the inhabitants of Palermo fell upon the French, who were all massacred. Before the end of April Messina and other towns followed the example of Palermo, and the Sicilian Vespers ended in the overthow of the domination of Charles of Anjou and the establishment of the Aragonese dynasty.

Sicily, the largest island of the Mediterranean, belonging to Italy, from the south-western extremity of which it is separated by the narrow strait of Messina. It forms a *compartimento* of Italy, with an area of 9935 sq. miles, and a pop. of (1915) 3,793,465. It is triangular in shape, ending in the three capes of Faro on the north-east, Passero on the south, and Boeo on the west; whence the ancient poetical name of Trinacria. The greater part of the surface consists of a plateau of varying elevation. The lower slopes of the mountains of the north are clothed with olive-yards and orange-groves, mulberry-gardens and vineyards, and their higher slopes with forests of oak and chestnut. The highest elevation in Sicily is the active volcano of Etna, in the east of the island, which rises to a height of 10,739 feet. To the south of Etna, on the east coast, is the plain of Catania, the only plain of any great extent. It is watered by the Simeto. The principal perennial streams, besides the Simeto, are the Salso, Platani, and Belice. The climate, as in the other regions of the Mediterranean, is mild and equable, but its salubrity is impaired by the sirocco, and, locally, by the occurrence of malaria. Cereals and fruits of every variety are extensively grown. Viticulture is progressive. Almonds, hazel-nuts, and chestnuts are widely cultivated. The chief exports are fruits, wine, and sulphur, besides olive-oil, sumach, cream of tartar, &c. Sicilian sulphur is extensively exported, the centre of this trade being Girgenti on the south coast, and has practically a monopoly of the world's markets. Tunny and sardine fisheries are lucrative. The chief seats of foreign commerce are the three principal towns, Palermo, Messina, and Catania.

History.—At the dawn of history the older races inhabiting Sicily, the *Iberian Sicani*, from Iberia (Spain), and the *Siculi*, from Italy, are seen to be hemmed in by Phœnician and Greek colonies. The Greeks, who entered the island in the eighth century B.C., founded the great cities of Syracuse, Agrigentum, and Messina, drove the Phœnicians to the north-west coast, and spread their influence and culture over the whole island. Greek art and literature flourished, and many Greek names of distinction are connected with Sicily. The Carthaginians subsequently took the place of their kinsmen, the Phœnicians, and between them and the Greeks a struggle ensued, which ended in favour of the latter (480 B.C.). War with the Carthaginians (first Punic War) brought the Romans to Sicily, and, having acquired the Carthaginian portion of the island (241 B.C.), they extended their rule over the whole, Sicily becoming a Roman province in 212 B.C. On the decline of the Roman Empire the island was overrun by the Goths, who retained possession till A.D. 551, when Sicily became part of the Byzantine Empire. In the beginning of the ninth century the Saracens became masters, and continued so till their expulsion by the Normans. For the later history of Sicily, see *Roger I*; *Roger II*; *Frederick II* (Hohenstaufen); *Charles V* (German Emperor); *Charles VI* (German Emperor); *Naples*; *Sicilian Vespers.*—BIBLIOGRAPHY: E. A. Freeman, *History of Sicily*; A. J. C. Hare, *Sicily*; F. M. Crawford, *Southern Italy and Sicily.*

Sickingen, Franz von, German knight, born in 1481, died in 1523. A protector of Ulrich von Hutten and a friend of the Humanists, he became an ardent adherent of Luther. In 1522 he began war against the Archbishop of Trèves, but failed in his attack on the city. He was besieged in his own castle of Landstuhl and mortally wounded.

Sicyon, a city of ancient Greece, near the Gulf of Corinth, celebrated for its schools of sculpture and painting, bronze casting, carving, and pottery. At first dependent upon Argos, it was afterwards closely allied to Sparta, which it aided in the Peloponnesian War. Under Aratus (251 B.C.) it became one of the most important cities of the Achæan League, of which it finally shared the fate, falling under the dominion of Rome. In the second century A.D. it was almost depopulated.

Siddons, Sarah, British actress, born at Brecon, South Wales, 1755, died 1831. The daughter of Roger Kemble, an actor-manager, she commenced her theatrical career when quite a child, and in her nineteenth year was married to William Siddons, an actor in her father's company. In 1774 she met with the first recognition of her great powers as an actress at Cheltenham. She then went to Drury Lane, but her first appearance there was a comparative failure, and in 1777 she again went on circuit in the provinces. Her second appearance at Drury Lane took place in Oct., 1782, in the character of Isabella in the *Fatal Marriage.* Her success was complete, and from that time till she retired in 1812 she was universally acknowledged to be the first tragic actress of the English stage. Her greatest characters were Queen Catherine in *Henry VIII*, and Lady Macbeth. On 17th Oct., 1922, a memorial to Mrs. Siddons was unveiled at Bath by Miss Ellen Terry.

Sidesaddle-flower, a plant of the genus Sarracenia. See *Sarraceniaceæ* and *Carnivorous Plants.*

Sidgwick, Henry, British philosopher, born in 1838, died in 1900. He was educated at Rugby and Trinity College, Cambridge, and became a Fellow and lecturer of his college in 1859. In 1875 he was appointed lecturer in moral philosophy at Trinity College, and in 1883 Knightbridge professor of moral philosophy in the university. His works include: *Methods of Ethics* (1874), *Principles of Political Economy* (1883), *History of Ethics* (1886), and *Practical Ethics* (1898). In his philosophy Sidgwick was an adherent of utilitarianism on an intuitional basis. He was one of the founders of the Society for Psychical Research.

Sidney, or **Sydney**, Algernon, second son of Robert, second Earl of Leicester, born in 1622, died in 1683. He was early trained to a military life, and served with some distinction in Ireland, where his father was Lord-Lieutenant. In 1643 he returned to England and joined the Parliamentary forces. In 1645 he was given the command of a cavalry regiment in Cromwell's division of Fairfax's army, and was returned to Parliament for Cardiff. He refused all concurrence in the government of Cromwell, retiring to Penshurst, but when the return of the Long Parliament in May, 1659, gave expectations of the establishment of a republic, he again took his seat, and was nominated one of the Council of State. He was soon after appointed a Commissioner to mediate a peace between Denmark and Sweden, and while he was engaged in this embassy the Restoration took place. Conscious of the offence he had given the Royal party, he refused to return, and remained an exile for seventeen years. At length, in 1677, the influence of his friends procured him permission to return to England. On the discovery of the Rye House Plot he was arrested and sent to the Tower on a charge of high treason. His trial before the notorious Chief Justice Jeffreys was conducted with a shameless absence of equity which has conferred upon him all the glory of a martyr. He was executed on Tower Hill, 7th Dec., 1683. His *Discourses concerning Government* were first printed in 1698.—Cf. A. C. Ewald, *Life and Times of Algernon Sidney.*

Sidney, Sir Philip, English soldier and poet, born 1554, died 1586. The son of Sir Henry Sidney of Penshurst, he was one of the most conspicuous figures at the court of Queen Elizabeth, who sent him in 1577 on an embassy to Germany. In 1585 he went to the Netherlands with his uncle Dudley, Earl of Leicester, who commanded the forces sent to assist the Dutch against the Spaniards, and he was appointed Governor of Flushing and general of horse, but at Zutphen, 22nd Sept., 1586, he was mortally wounded. Sir Philip Sidney was a soldier and statesman of great promise, and his contributions to literature, though not numerous, were of great importance. They include: the *Arcadia*, a romance in a medley of prose and verse in an Italian style then popular; *Astrophel and Stella*, (Sonnets); and the *Defence of Poesy*, published in 1595 as an *Apologie for Poetrie.* — BIBLIOGRAPHY: H. R. Fox Bourne, *A Memoir of Sir Philip Sidney*; J. A. Symonds, *Sir Philip Sidney*; Sir Sidney Lee, *Great Englishmen of the Sixteenth Century.*

Sidney Sussex College, Cambridge, was founded in 1595 by Lady Frances Sidney, dowager Countess of Sussex, aunt to Sir Philip Sidney. Oliver Cromwell and Thomas Fuller were members of this college.

Sidon, or **Saida**, a city of ancient Phœnicia, on the eastern coast of the Mediterranean, between Lebanon and the sea, about midway between Beirut and Tyre. In the Persian, Grecian, and Roman periods it was great and populous, and even in the Middle Ages it was a place of considerable importance. During the Crusades it was taken and retaken several times. It was almost completely destroyed during the troubles of the thirteenth century, but in the fifteenth it reappeared, under its modern name of Saida, as the port of Damascus. Pop. 12,000.

Siege (from the Lat. *sedere*, to sit, through the Fr. *siège*, a seat), the operation of surrounding or 'sitting down' in front of a town or fortress with the idea of causing it to surrender. This surrender might be attained either by so thoroughly investing the place that no one could get in or out and so starving the inhabitants into submission, or, if time pressed, by an investment followed by an assault on a part or the whole of the fortification. In sieges in early days the troops engaged were assisted by many strange engines roughly manufactured on the spot, such as battering-rams (q.v.). A process of mining was also used to undermine a suitable wall or tower and to cause it to subside by pressure of its own weight. Movable towers of two or more stories, provided with a drawbridge at the height of the wall and well packed with fighting men, were also a feature of sieges of old.

Then came a time when sieges became merely a matter of 'sitting down' and hoping that hunger would force the garrison to surrender. Another phase was reached when, as military art and science progressed and weapons of offence and defence became more effective, it became necessary to provide more efficient cover for the attackers than was given by the ancient engines. This led to the use of ground, and a properly conducted siege entailed much digging of zigzag trenches or 'saps', in which the working-parties might receive a fair measure of protection as they laboriously dug their way towards the walls; along these trenches the assaulting or reinforcing troops might move. From this word 'sap' is derived the old name of the Royal Engineers, i.e. Sappers and Miners, the name by which the engineers of the Indian army are still known. In the eighteenth century, when precision of movement was the be-all and end-all of military science, and the system of Vauban was still the only possible method of fortification, the art of besieging and assaulting a fortress became almost an exact science, and a series of progressive steps, which were as well known to the defenders as to the attackers, had to be undertaken (cf. Uncle Toby and Corporal Trim in *Tristram Shandy*). During the Peninsular War, and in India in the early nineteenth century, sieges were invariably undertaken merely as preparatory to an assault. A preliminary period was allotted to approach-work and bombardment with a view to providing a practicable breach in the fortifications, and once this was considered sufficient, the assault followed as a matter of course. All such sieges were undertaken at comparatively close quarters. The days of sieges culminating in an assault are over now, and a long-range bombardment is about the nearest approach to an old-fashioned siege which is likely to occur.

Siegen, a town of Germany, in the Prussian province of Westphalia, on the Sieg. It has manufactures of leather, paper, soap, and linen. In the vicinity are numerous iron-mines and smelting-furnaces. Until 1806 it was part of Nassau, and was given to Prussia in 1815. Pop. 28,000.

Siemens, Sir William, engineer, was born in Hanover in 1823, and died at London in 1883. His inventions were very numerous, and the superiority of the British patent laws induced him to settle in this country in 1843. His brothers Werner and Frederick were associated with him in most of his undertakings, but continued to live in Germany. The regenerative furnace was patented in 1856, and its application to the manufacture of steel in the Siemens-Martin and Siemens processes followed a few years later. In 1858 the brothers began the manufacture of submarine cables, and great works were established in Kent in 1866. The firm laid the direct Atlantic cable in 1874, and took a leading part in the introduction of the dynamo, and of electric lighting. William Siemens was elected F.R.S. in 1862, was president of the British Association in 1882, and was knighted in 1883.

Siena, a province of Tuscany, Central Italy. Area, 1470 sq. miles; pop. 245,000.

Siena, or **Sienna** (ancient *Sena Julia*), a city of Tuscany, capital of the province of Siena, Central Italy. It is surrounded by old walls, entered by nine gates, and has also a citadel; the streets are irregular, steep, and narrow. There is a university and an ancient cathedral. In the Middle Ages Siena gave its name to a school of painting, and was the birthplace of famous painters, sculptors, and architects. It was long the powerful rival of Florence, but was annexed to Tuscany in 1557. Siena is the seat of an archbishop. Pop. 42,500.

Sienkiewicz (syen-kyā'vich), Henryk, Polish novelist, born in 1846, and died in 1916. Educated at Warsaw, he studied philosophy, and made his literary début in 1870 with a sketch of Kiev student life, entitled *In Vain*. Among his works are: the trilogy of *With Fire and Sword*, *The Deluge*, and *Pan Michael*; and *Quo Vadis*, a Christian romance of the times of Nero, which gained him world-wide fame. Among his later works are: *Knights of the Cross*, *On the Field of Glory*, and *In Life's Whirlpool*. He received the Nobel prize for literature in 1905.

Sierra Leone, a Crown colony and protectorate of West Africa, lying between French Guinea and Liberia. The total area is about 27,300 sq. miles, with a coast-line of 210 miles between the Great Skarsies and Mano Rivers. *Colony.*—The colony lies along the coast between the Skarsies and the Liberian frontier, and extends inland for from 9 to 20 miles. Sherbro and other islands and the Sierra Leone Peninsula (area, 330 sq. miles) are included in the total area of 4000 sq. miles; pop. 75,590 (about 1000 whites). Freetown (pop. 35,000) is the capital. Kola-nuts, palm-oil, kernels, and ginger are exported; tobacco, kerosene, cotton, and coal are imported. There is a Governor and commander-in-chief, who is assisted by nominated Executive and Legislative Councils. *Protectorate.*—The protectorate extends north and south between the parallels of 10° and 6° 55′ N. lat. Area, 27,000 sq. miles; pop. about 1,400,000. There are three provinces (Northern, Central, and Southern), each under a commissioner assisted by divisional commissioners. The Governor of the colony is Governor of the protectorate, and the Legislative Council has a measure of authority. Palm-oil, kola-nuts, and palm-kernels are the chief exports; cotton, hardware, and tobacco are imported; rice, cassava, millet, and maize are the staple crops.

Physical.—There are two main divisions: (1) a low coastal plain, built up of a series of young sediments resting upon a platform of crystalline, sedimentary, and volcanic rocks; and (2) the plateau, or upland region of the hinterland, forming a continuation of the Futa-Jallon massif, and rising from 1000 to 6000 feet altitude. These granitic, dome-shaped mountain masses are smooth, symmetrical, and bare of vegetation excepting grass, and they contrast strangely with the forest-clad slopes of the rough and jagged noritic massif (3000 feet altitude) which rises abruptly from the seaward margin of the narrow coastal plain on Sierra Leone Peninsula. The Rokell, Jong, Boom (or Sewa), Mano, and Skarsies are the principal rivers. The climate is tropical; the wet season begins in May and ends in November, when the dry season commences. The low-lying mangrove-fringed tidal areas of the coastal plain are malarious and deadly to Europeans, but the elevated regions are fairly healthy. *Communications.*—There were 338 miles of railway in 1922. The main line (227½ miles) extends from Water Street (Freetown) to Pendembu, and there is a branch from Boia to Kamabai (104 miles, extending to Ka Bohosa).

History.—In 1787 a party of colonists received from King Tom a grant of land (about 20 sq. miles) where Freetown now stands. The Sierra Leone Company was chartered in 1791, and to it the native kings ceded the whole of Sierra Leone Peninsula and dependencies. The Crown took over administration in 1808; in 1886 telegraphic communication with England was inaugurated, and in 1896 the hinterland of Sierra Leone was proclaimed a protectorate. An insurrection of native chiefs necessitated military operations of a punitive nature, but since then the protectorate has remained entirely peaceful. Sierra Leone is the only British West African colony which was instituted as such; all others were primarily trading-posts.

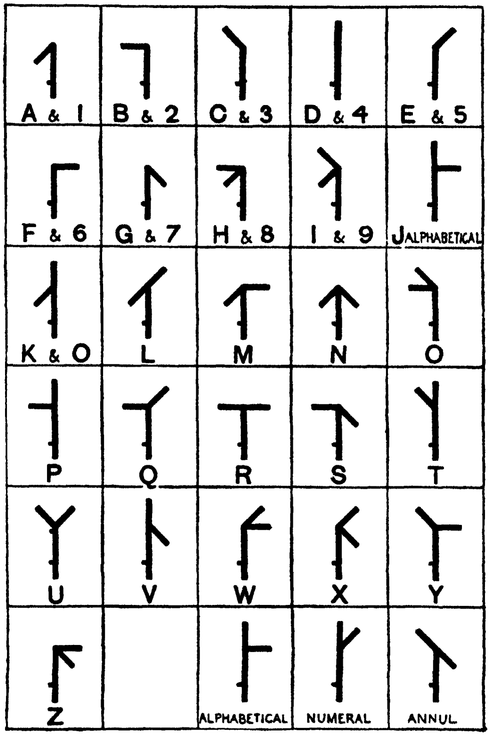
Sieve-tubes, of plants, the vessels mainly responsible for the transport of 'plastic' materials, i.e. the complex food-substances manufactured in the leaves and elsewhere. In their cross-walls are numerous fine perforations (sieve-pores), through which non-diffusible substances, such as proteins, can pass freely. See *Vascular Tissues*.

Sieyès (sye-yās), Emmanuel Joseph, better known as the Abbé Sieyès, French revolutionary leader and political philosopher, born in 1748, died in 1836. During the Terror he withdrew into the country, but after Robespierre's downfall he returned to the Convention. In 1799 he became a member of the Directory. He took an active part in the Revolution of the 18th Brumaire, the new Constitution being devised by him. But Sieyès soon found his speculations completely overmatched by Bonaparte's practical energy, and his political career ended.

Sigillaria, a genus of fossil plants found in great abundance in the Coal-measures. The plant occurs in the form of stems attaining a height of 40 to 50 feet, and a breadth of 5 feet. The stem generally occurs compressed as a double layer of coal with a fluted outer surface, and showing, at regular intervals and in vertical rows, the scars produced by the bases of the leaf-stalks. These scars resemble the impressions of circular seals, whence the name of the genus. The roots are found in the underclay, and, like those of Lepidodendron, are known by the name of *stigmaria*, being at first supposed to be distinct plants. No foliage of any kind has been found connected with the trunk. Sigillaria is a gigantic ally of the modern club-mosses. Reproductive cones are known.

Sigismund, German king and Holy Roman Emperor, was born in 1368, died in 1437. On the death of his father, the Emperor Charles IV, he obtained the margraviate of Brandenburg, and was crowned King of Hungary in 1387. He was subsequently involved in a war with Turkey, and, being defeated by Bajazet at Nikopolis in 1396, fled into Greece. On his return to Hungary in 1401 he was made prisoner, and the nation gave the throne to Ladislaus of Naples. Sigismund escaped, and, having raised a powerful force, reduced Hungary to subjection. In 1411 he was elected Emperor of Germany. He took a leading part in the Council of Constance in 1414, but disgraced himself by allowing John Huss, to whom he had granted letters of safe-conduct, to be put to death. On the death of Wenceslaus in 1419 the Hussites refused to acknowledge his succession to the Kingdom of Bohemia until he had signed the compact with the Council of Basel in 1431. He was then crowned emperor at Milan, and again at Rome in 1433.—Cf. A. Main, *The Emperor Sigismund.*

Signalling. The normal definition of this word is 'the method of transmitting intelligence to a distance by means of sight or hearing'. In a military sense the term includes all means of intercommunication for the army in the field by line telegraphy and telephony, wireless, visual and message-carrying agencies; also the interception of enemy messages and certain communications with air-craft. Signalling as practised in the army is one of the most important aids to intercommunication, without which no military operation can be a success. Without intercommunication there can be no co-operation; moreover, the rapid distribution of information gained by reconnaissance (q.v.) requires an efficient and detailed organization. This, under modern conditions, is provided by the Royal Corps of Signals.



Semaphore Signs and Significations

The means available for signalling are roughly four in number: (1) flags, (2) heliograph, (3) lamps, (4) shutters.

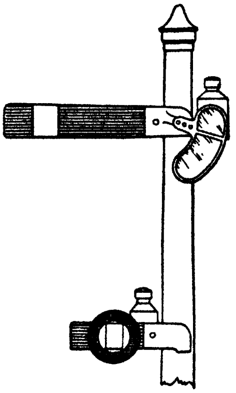
Flags.—Flags can be used in daylight only, and they are useless in foggy weather. Two kinds of flags are in use, one 3 feet and the other 2 feet square, and there are two methods of forming letters. In the first method a single flag is used to send letters or figures by means of the Morse code of dots and dashes, a dot made by a flag being represented by a short, quick movement, and a dash by a longer one. In the second, or Semaphore method, the letters are represented by either one or two flags, held at certain angles to the body of the sender. By this method words can be spelled out more quickly than with the Morse flag, but they cannot be read at such a great distance. With the large Morse flag, messages sent from a distance of 5 miles can be read by the aid of a telescope under good conditions; semaphore, under the same conditions, can rarely be read at a greater distance than 1½ miles.

Heliograph.—The heliograph depends for its effect on the reflection of the light of the sun from a mirror or combination of mirrors on to a distant station, and the instrument in use in the army is a strongly made, portable, and easily adjusted one, which enables this principle of reflection to be utilized. Naturally, bright sun is a *sine qua non* for its use, and in consequence it is of more value in India and similar countries than in Europe. Under favourable conditions of light, and in suitable country, messages sent by helio in the Morse code can be read at a distance of 70 miles.

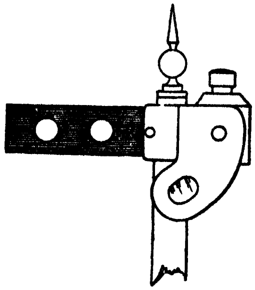
Lamps.—Lamps, specially constructed for the purpose, and fitted with an electric apparatus giving an 8-candle-power light, and powerful reflectors, can be used either in daylight or at night. In the former case, signals can be read at a distance of some 4 miles, while at night this distance is doubled.

Shutters.—Shutters are small portable affairs usually made of American cloth, having a black surface changing to white when the signalling surface is exposed. With this contrivance, messages in the Morse code can be sent at short distances (up to about 600 yards), and it has been found of use for intercommunication in companies and batteries.

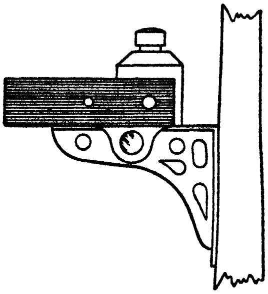
A machine for producing semaphore signals is carried on all war-ships, usually on the bridge, and a search-light, provided with a Venetian shutter, is commonly used for long-distance signalling.



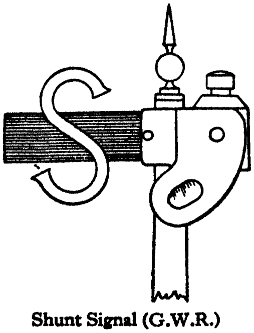
Home Signal (the distant signal has a fish-tail) end and 'Calling on' Arm. (L.B. & S.C.R.)



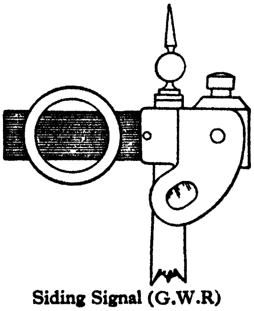
Backing Signal (G.W.R.)



Loop Signal (G.W.R.)



Shunt Signal (G.W.R.)



Siding Signal (G.W.R)

Railway Signals

Signalling, Railway. The simplest form of train protection before the introduction of telegraphy was division of the line into sections or blocks with a passing loop at each block-station; trains, when dispatched in the same direction, being controlled by time-limits. The first block-signals were rotating vertical posts, each carrying a crossbar surmounted by a disc at right angles to it, so that both signals would not be visible at the same time, the crossbar signifying *danger* and the disc *all right*. Semaphore signals for railways were first introduced in 1841, and with various improvements are still adopted for train control. The two essential signals are the distant and home or stop signals, the former easily recognized by its fish-tail end, and the latter by its square end. *Danger* and *all right* are indicated respectively by the horizontal and inclined position of the arms; this is the convention used on all railways. The distant signal at danger means 'proceed with caution, prepare to stop at home signal', and the home signal at danger means 'stop'. Other running signals used are called 'inner' and 'outer homes', 'starters' and 'advance starters' according to their location, but the indication and significance of these is the same in all cases as for the home signal. Other auxiliary signals are: *calling-on* arms, *backing* signals, *siding*, *shunt*, *banner*, and *loop* signals. Home signals are placed at the fouling points of a junction, at a siding connection, and at the entrance to a station; they are about 800 yards in advance of the distant signal at the approach end of the station. The distant signal is interlocked with the home, so that the *all right* can only be given when both are lowered for proceeding into the next section. The starting signal is placed at the departure end of the platform, and protects the entrance to the next block. Starting advance signals are sometimes adopted to provide the necessary protection when the starting signal is less than a full train-length in advance of the trailing points. A calling-on signal is generally on the same post, but fixed beneath the home signal, when the latter is too far away for the signalman to give verbal instructions; it indicates to the driver that he can proceed as far as he sees the line clear. Calling-on arms are of various shapes, according to the railway on which they are used.

Shunting signals are used for slow movements, such as entrance into a siding. The post is generally short, with a miniature arm. The combined detonator and ground signal carries a miniature arm as well as coloured targets.

The *lock-and-block* system of signalling, as the name implies, is a system of interlocking between the block instruments and the operating levers. It ensures that the starting signal permitting entrance into a block cannot be lowered until released by an electric current from the cabin in advance. Once the train has been accepted, the current cannot be circulated again until the train has cleared the block and the home signal has been raised to danger behind it.

To facilitate quick service of trains over long block-sections, *automatic signalling* is adopted. The trains themselves operate the signals electrically. A low-tension current is passed through the track rails, the joints of which are insulated at each end of the block-sections. All other joints within the section are bonded by sleeve-bonds, consisting of two small copper sleeves which pass over the ends of a copper-bonding wire of about $\frac{1}{8}$ inch diameter, and are driven into the web of the rail, thus tightening it upon the bond wire and ensuring good contact with the rail. When the section is clear, the track-circuit is maintained, and the signal at the entrance to the block is forced into the *all right* position. The train, however, on entering the section immediately short-circuits the current through the wheels and axles releasing the signal, which rises to *danger* by gravity. The signal is locked in this position until the train has passed the 'overlap' beyond the next signal, when the original track-circuit is restored, causing the signal to be again forced into the *all right* position. In this system the power operating the signal may be either all-electric or electro-pneumatic.

In one form of the *all-electric* type the main- and overlap-blocks are each bridged by two relays, known as 'pick-up' and 'auxiliary' relays. When the train passes the first signal and enters the overlap section, both home and distant signals immediately rise to danger, owing to the pick-up relay being de-energized in consequence of the train short-circuiting the track-circuit.

In the Westinghouse *electro-pneumatic* system, air is admitted to a cylinder by means of an electro-magnetic pin-valve, forcing the piston downwards and lowering the signal. Directly the track circuit is short-circuited, the electro-magnet becomes de-energized and cuts off the air-supply, thus opening the exhaust and allowing the arm to return to danger by gravity.

In foggy weather, the ordinary signals are practically useless and are supplemented by *detonators* placed on the rails and exploded by the train wheels, or by *fog-horns* operated by fog-men stationed at the distant signals. To minimize the risk run by these men in placing the detonators on the rails, many appliances have been patented, one of the most successful being the Clayton fog-signalling machine.

Signboards are now chiefly confined to public-houses and hotels, although the pawnbroker still shows three golden balls above his door, the barber his painted pole, and the chemist occasionally a pestle and mortar. Pliny speaks of signboards as in use in Greece, and excavation of the ruins of Pompeii brought to light numerous examples, chiefly carved. In mediæval England they expressed pictorially information which few passers-by would have been able to gain from written words. They were of many kinds, exhibiting familiar animals and fabulous monsters, with flowers, trees, &c. In a religious age ecclesiastical signs, such as the mitre, were naturally numerous, and saints and martyrs had their place. Heraldic signs were plentiful. The hero of some victory by land or sea was pressed into the service of the sign, as Admiral Benbow, the Marquis of Granby, and the Duke of Wellington. Many signs depicted the nature or use of the wares offered for sale. Others were of a humorous nature; misogyny was displayed in one or two well-known examples, as in the sign of *The Good Woman*, who was headless and thus could not speak; and *The Man loaded with Mischief*, shown carrying his wife on his back. Others took the form of a rebus, often on the name of the owner, as that of the *Two Cocks* for a tradesman named Cox; of a *Fountain* for the publisher Drinkwater. The signboard usually projected at right angles from the house-front, hanging from a wooden or iron frame, the latter often being of no small beauty of design; but some were raised upon a post before the tradesman's door, as they sometimes are still in the south of England. Sign-painting, frequently combined with coach-painting, was a thriving business. Distinguished artists sometimes painted signs. George Morland is known to have executed a *Goat in Boots* and a *White Lion*; the elder Crome was painter of a Norwich sign; while David Cox's *Royal Oak* at Bettws-y-Coed is still happily preserved. The noisy creaking of heavy signs swaying in the wind, some fatal accidents caused by their fall, and still more the step of numbering houses in a street, led to their general disappearance; but as late as 1868 the removal of the sign of the *Sir John Falstaff* Inn at Canterbury had to be effected at an early morning hour, a riot being feared by the authorities.—Cf. Larwood and Hotten, *History of Signboards*.

Signorelli (sĕn-yo-rel′lē), Luca (called also, from his birth-place, *Luca da Cortona*), Italian painter, was born at Cortona about 1441, died there 1523. His greatest work is a series of frescoes in the cathedral of Orvieto, representing the *History of Antichrist*, the *Resurrection of the Dead*, and *Hell and Paradise*. These have proved an important source of inspiration to later painters, notably Michelangelo. Though a realist of the fifteenth-century type, who makes an almost exaggerated use of anatomical knowledge, Signorelli shows a use of light and shade and a breadth of handling which make him a precursor of the High Renaissance. His other works include: the *Madonna Enthroned*, in the cathedral of Perugia; the *Adoration of the Magi*, now in the Louvre; the *Annunciation*, and a *Madonna*, both at Volterra; and a *Madonna and Saints*, in the National Gallery.

Sikhs, one of the principal fighting classes of India, from which recruits are obtained for the Indian army. The Sikhs come from the Punjab, and constitute practically a militant-religious community. Their history dates back to Nanak (fifteenth century), who founded the sect as a dissenting offshoot of Hinduism. The abolition of caste was his fundamental dogma, and the sect remained a purely religious one until the eighteenth century. During this period they were persecuted by the (Mahommedan) Moghal emperors, and, under the leadership of Ranjit-Singh, the 'Lion of the Punjab', became welded into a powerful confederacy with head-quarters at Lahore. Ranjit-Singh made a treaty with the rapidly expanding East India Company, and agreed not to cross the Sutlej, but, after his death (1839) and the military catastrophe of the First Afghan War, the Sikhs struck a blow at British domination. The first Sikh War (1845) was followed (1849) by the second Sikh War, when Dhuleep-Singh (Ranjit's son) was deposed and exiled to England. Thus the Punjab became British. Originally drawn largely from the Jat (yeoman-proprietor Hindus), the Jat-Sikh remains the chief and the best class of Sikh enlisted in the Indian army of to-day, but the Mazbi are enlisted for pioneer services. No man is born a Sikh; he can become one only on the attainment of a certain age and after formal initiation. A Sikh must neither cut the hair nor touch tobacco; steel must be carried on the person, and the back must never be turned to an enemy. Most Sikhs wear a steel bracelet on one wrist, and in the purely Sikh regiments all native ranks when in uniform wear a steel quoit (one of their ancient weapons) round the turban. Patiala, Jhind, Nabha, and Kapurtala are the principal Sikh states, and all maintain Imperial-service troops for use as required.—BIBLIOGRAPHY: J. D. Cunningham, *History of the Sikhs*; L. Griffin, *Ranjit Singh and the Sikh Barrier against Central Asia* (Rulers of India Series); F. P. Gibbon, *The Lawrences of the Punjab*.

Sikkim, a protected Indian state in the Himálaya, bounded on the north and north-east by Tibet, south-east by Bhutan, south by Darjeeling, and west by Nepál; area, 2818 sq. miles. The largest river is the Tista, which, like the rest of the drainage, belongs to the basin of the Ganges. The climate is unhealthy in the valleys, but salubrious above 4000 feet. Cereals and rice are raised. The aboriginal inhabitants are Lepchas, with marked Mongolian features and a language radically Tibetan. The capital is Gangtok. Pop. (1921), 81,722.

Sile′ne, a genus of plants belonging to the nat. ord. Caryophyllaceæ. The species are in general herbaceous, many annual, very few shrubby. Eight are included in the British flora. Moss campion or stemless catch-fly (*S. acaulis*), with purple flowers, is found on the hills of Scotland, Devonshire, and Cumberland. Bladder campion (*S. inflata*) abounds in almost every field and wayside. It is about 1 foot high, and has white flowers, with an inflated calyx.

Sile′nus, a Greek deity, the foster-father and constant companion of Bacchus, and likewise leader of the satyrs. He was represented as a robust old man, generally in a state of intoxication and riding on an ass, carrying a cantharus or bottle.

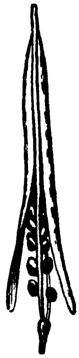
Sile′sia, a region of Central Europe, divided as follows: (1) two provinces of Prussia, (*a*) Lower Silesia (area, 10,270 sq. miles; pop. 2,987,900), (*b*) Upper Silesia (area, 4098 sq. miles; pop. 2,284,000); (2) a county of Poland (pop. 1,125,500); (3) a province of Czecho-Slovakia (area, 1707 sq. miles; pop. 671,000). There are two coal-fields in this region, one in Upper Silesia and the other in Lower Silesia; lignite in Upper Silesia, iron, silver (associated with large deposits of lead and zinc), arsenic (the largest mines and smelting-works in the world), and pyrites are among other mineral riches. Silesia is also a producer of sugar, beer, spirits, cotton, linen, wool, paper and wood-pulp, chemicals, glass and pottery, cement, machinery, and pianos. Breslau, Görlitz, Königshütte, Liegnitz, Beuthen, Gleiwitz, Zabrze, and Opava (Troppau) are the chief towns.

Article 88 of the Versailles Treaty provided for a plebiscite being taken to decide the ownership of Upper Silesia. This was taken on 20th March, 1921, when 716,408 votes were cast for union with Germany, and 471,406 for Poland.[1] Owing to the peculiar distribution of the vote, however, the Inter-Allied Supreme Council failed to agree on the proportions to be allocated to each state, and the matter was referred to the League of Nations. The Council of the League published its decision on 20th Oct., 1921. A plan was evolved whereby Germany was allotted the largest area, contiguous with Prussia, but the economic unity of the Silesia region has been preserved intact.

Sil′ica. See *Quartz.*

Silica-glass. See *Quartz.*

Sil′icon (symbol, Si; atomic weight, 28·3), next to oxygen the most plentiful of the elements. It does not occur in the free state in nature, but always combined either with oxygen as silica or quartz (q.v.), or with metallic oxides as silicates. Silicon has certain chemical resemblances to carbon. It readily burns in air, forming silica (SiO_2). It is not attacked by mineral acids, with the exception of hydrofluoric acid; it combines with hydrogen, fluorine, and chlorine to form well-marked compounds, and with many metals to form silicides. See *Carborundum.*



Siliqua of a Crucifer

Sil′iqua, in botany, a kind of seed-vessel, such as the long pod-like fruit of crucifers. It is characterized by dehiscing by two valves which separate from a central portion called the *replum.* It is always superior to the calyx and corolla. The seeds are attached to two placentæ, which adhere to the replum, and are opposite to the lobes of the stigma.

Silis′tria, a town of Roumania, in the Dobruja, on the Danube. Silistria was strongly fortified up to 1878, when the fortifications had to be dismantled in accordance with the terms of the Berlin Treaty. Pop. 12,000.

Sil′ius Italicus, Titus Catius, a minor poet in quality though not in quantity of output, was born in A.D. 25, and died in A.D. 101. He was a prominent public man, was consul in the year of Nero's death (68), became an intimate friend of Vitellius, and was afterwards proconsul in Asia. He was a whole-hearted admirer of Virgil and Cicero, and owned what had been their estates at Naples and at Tusculum. His epic poem *Punica* is in seventeen books and 14,000 lines. Its author intended it to be in twenty-four books, so as to fall into line with the *Iliad* and *Odyssey,* but he got weary at the end of the seventeenth book. The reader, if any such there be, becomes weary much sooner. Silius was happy and distinguished in everything save his poetry. The *Punica,* a tasteless mixture of fact and mythology, is a far more completely worthless epic than those of Statius or that of Valerius Flaccus. It is incredibly dull, and not even unintentionally amusing.

Silk, Artificial, a substitute for natural silk, prepared from cellulose by several processes. In one of these the cellulose is nitrated, as in the manufacture of pyroxyline, and after further treatment is converted into a thread suitable for textile materials by being forced under pressure through a capillary tube, terminating in an orifice about one-tenth of a millimetre in diameter. As the cellulose leaves the orifice and comes into contact with liquid or air, it sets to a transparent jelly of considerable toughness. After winding, a number of filaments are united and wound as a single compound yarn to form the artificial silk yarn of commerce. When thoroughly dry the thread has a high lustre equal to, and often greater than, that of real silk. Its manufacture was, at one time, a dangerous occupation, because of the inflammable nature of its constituents, but most of these dangers have been eliminated by modern methods of manufacture. In the dry state its tensile strength is less than half that of real silk, while when wet it compares even less favourably with silk. Artificial silk is now used extensively in the manufacture of hosiery of various forms, linings, ties, and trimmings for dresses and millinery.

Silk and Silkworm. The fabric silk is manufactured from the glossy thread obtained from the larvæ of certain moths. The chief silk-producing larvæ belong to the family of the Bombycidæ, of which group the common silk-moth (*Bombyx mori*) is the most important species. It possesses a short body, stout legs, and white wings, which are marked by black lines running parallel with the wing borders. The female moth deposits her eggs in summer on the leaves of the mulberry tree (*Morus alba*). For hatching artificially the eggs are placed in a room heated gradually up to a temperature of about 80° F. In eight or ten days the young appear. The caterpillars are then covered with sheets of paper on which mulberry leaves are spread, and make their way through perforations in the paper to the mulberry leaves, their natural food. The leaves when covered with caterpillars are laid on shelves of wicker-work covered with brown paper. When first hatched the larvæ or worms are black and about ¼ inch long. The larval or caterpillar stage lasts from six to eight weeks, and during this period the insect generally casts its skin four times. After casting its last skin the insect is about 2 inches long, and in ten days attains its full growth of 3 inches. At this stage the insect becomes languid, refuses food, and prepares for its next change into the pupa or chrysalis stage. Oak, broom, or other twigs are now laid on the wicker frames, and the worms crawl into these, where they spin their cocoon by winding a self-produced silk thread many times round their body. This silky thread is formed from a glutinous secretion contained in two tubular glands on either side of the body, opening on the lower lip of the larva in a prominent aperture called the *spinneret*. This secretion becomes tenacious and thread-like when brought in contact with the air, and the two filaments unite as they issue from the spinneret. The spinning of the pupa-case or cocoon lasts from three to five days. After passing about three weeks in the nymph or chrysalis stage, the larval form emerges from the cocoon as the perfect moth or *imago*. But those insects destined to afford the silk material are not allowed to enter the *imago* stage. The completed cocoon with its contained larva is thrown into warm water, which dissolves the glutinous matter cementing the threads together, and facilitates the unwinding of the silk. The average length of a thread furnished by a single cocoon is 300 or 400 yards. About 12 lb. of cocoons yield 1 lb. of raw silk, and 1 oz. of silkworms' eggs will give 100 lb. of cocoons. The female moth produces from 300 to 500 eggs.

---

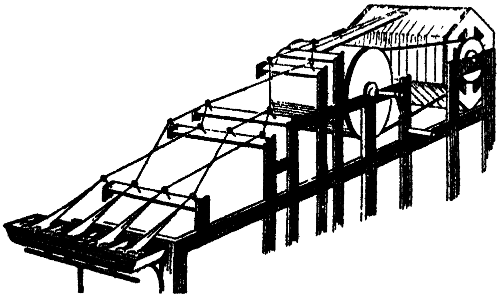
[1] The figures quoted are those given by the Inter-allied Commission under whose control the voting took place.

Common Silk-moth (*Bombyx mori*)

1, Caterpillar. 2, Cocoon. 3, Moth. 4, Eggs.

In Europe some moths produce one generation, others two generations annually; but the caterpillars from the former class produce the best silk. In India some forms produce eggs monthly, while three or four generations annually are not uncommon in that country. A valued variety of the *Bombyx mori* is the Novi race of Italy, which spins a large white oval cocoon. The *Bombyx Yama-mai*, or Japanese oak-feeding silk-moth, produces a green cocoon, the silk of which is much used for embroidery. *B. Peryini* inhabits Northern China and is also an oak-feeder. Its cocoon is large and greyish-brown in colour. The *B. Cynthia* of China and North Asia manufactures a grey cocoon, from which the Chinese manufacture a silk recognized by its soft texture. From the cocoon of the *Antheræa Paphia* of India, or '*tussur* moth', the natives manufacture the Tussur silk fabric. *Bombyx textor* of Bengal makes a pure white silk used by the natives.

The Chinese appear to have been the first to render the filamentous cocoon substance serviceable to man, and China is still the chief silk-producing country in the world. The culture of the silk-worm was not introduced into Europe until the sixth century. It was at first confined to Constantinople, but soon spread to Greece, and then through Italy to Spain. When the Duke of Parma took Antwerp in 1585, a check was put on its trade in silk goods, and many of the weavers from Flanders and Brabant took refuge in England. In 1685 the revocation of the Edict of Nantes drove hosts of silk-workers into exile, as many as 50,000 having settled in Spitalfields, London. A silk-throwing machine, constructed on Italian models secretly obtained, was fitted up at Derby in 1714 by Thomas Lombe (afterwards Sir Thomas Lombe), who obtained a patent in 1719, and on its expiration received a grant of £14,000 for his services to his country. In France looms were set up at Lyons in 1450, and at Tours in 1470.



A simple Silk-reeling Machine

Italy is now the chief silk-producing country in Europe, France coming next.

In the manufacture of silk the first operation is the unwinding of the cocoons and the *reeling* of the silk. The ends of the filaments are conducted by guides to large reels moved by machinery. Four or five (or more) threads from as many different cocoons are thus brought together, and uniting by the gum form one thread. When the cocoon is half unwound the filament decreases 50 per cent in thickness. The silk thus produced is called *raw silk*. Before it can be woven into cloth the raw silk must be *thrown*. Previous to *throwing*, the silk is usually washed, wound on bobbins, cleaned during the winding process, and assorted. In the throwing-machine it is again unwound from the bobbins, twisted by the revolutions of a flyer, and then wound on a reel. The silk thus prepared is called *singles*, and is used for weaving common or plain silks and ribbons. The next operation, called *doubling*, is the twisting of two or more of these threads on one bobbin. This is done in a throwing-machine, and the silk thus spun is called *tram* silk, commonly used for the weft of richer silks and velvets. Two or more of these threads of tram-silk twisted in the throwing-mill together constitute *organzine*, a species of silk thread used for warps of fine fabrics. But in tram-silk the threads are all twisted in one direction, forming individual strands like twine, whereas in organzine the collected threads are twisted in an opposite direction to the twist of the strands, like cable or rope. Silk yarns are long, uniform in diameter, fine, elastic, lustrous, and durable. They can be readily loaded when weight is desired, and have a great affinity for colouring-matters. In the manufacture of silk fabrics France holds the leading place in Europe, Lyons being the chief seat of the trade. In Britain silk fabrics are manufactured at Braintree, Bradford, Brighouse, Coventry, Macclesfield, Derby, Spitalfields in London, Manchester district, Nottingham, Yarmouth, and in Ayrshire, Scotland. — BIBLIOGRAPHY: L. Duran, *Raw Silk*; L. Hooper, *Silk: its Production and Manufacture.*

Silk-cotton Tree (*Bombax ceiba*), a tree belonging to the nat. ord. Sterculiaceæ, indigenous to the West Indies and South America. The down which is contained in the seed capsule is used for stuffing pillows, chairs, sofas, &c. Canoes are constructed from the timber.

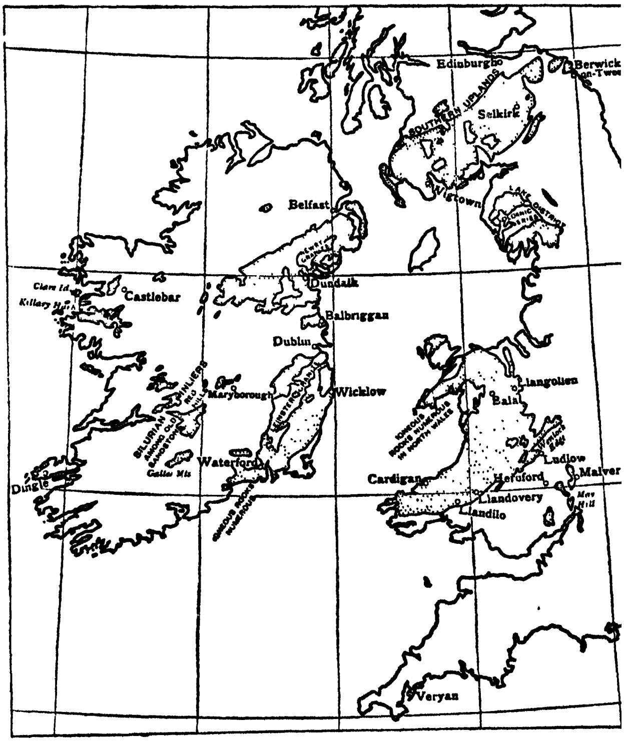
Silk Waste, inferior qualities of silk from the cocoons, and, in general, all forms of silk which are unsuitable for manufacture into typical silk fibre. Until about 1857 this waste was entirely useless, but it is now the object of an important industry, being cleared of the gum by boiling, and subjected to such processes as breaking, combing, drawing, and roving, till it is ready for spinning.

Silkworm-gut, a substance prepared from the silky secretion (drawn-out glands) of the caterpillars of the ordinary silk-worm taken at the time when they are ready to spin their cocoons. It is used for dressing the hook end of fishing-lines.

Silloth, a seaport and watering-place of England, in the county of Cumberland, on the coast of the Solway Firth, 18 miles west of Carlisle, for which it is the port. Pop. about 2000.

Silu′res, an ancient British tribe which inhabited the district included in the modern counties of Hereford, Radnor, Brecknock, Monmouth, and Glamorgan. They were of the earlier Celtic stock, and were amongst the most warlike of the British tribes.

Silurian, a name given by Murchison to the system of strata and the geological period between the Cambrian and the Devonian. In it



Map of the Silurian System of Great Britain early sense, and as used generally by continental writers and in publications of the Geological Survey of Great Britain and Ireland in the nineteenth century, the Silurian system includes the following series, arranged from the base upwards: *Arenig, Llandilo, Bala and Caradoc* (with *Ashgillian* at top), *Llandovery, Wenlock, Ludlow* (see *Bala Beds*; *Caradoc Series*; &c.). The term Silurian was restricted by the Cambridge school, following Sedgwick, to the last three series only, and this custom is now very prevalent. To avoid confusion, especially when using older literature, the lower three series have been called *Ordovician*, and those above the Ashgillian beds *Gotlandian.* Remains of primitive fishes and large eurypterida characterize the highest Silurian beds in Scotland; but the trilobites were predominant throughout the period. The flora is unknown. Cf. *Memoirs of the Geological Survey: Silurian Rocks of Britain* (H.M. Ordnance Survey Office).

Silver, a metallic element; symbol, Ag, from the Lat. *Argentum*; atomic weight, 107·88. A knowledge of both silver and gold dates back to remotest antiquity, probably owing to the fact that both metals occur native in a pure state, and also to the fact that they are comparatively readily fused and extracted from their ores. The pure metal has a whiter colour than any other metal or alloy, takes a very fine polish, and is softer than copper but harder than gold. Its specific gravity is 10·5. It is next in malleability to gold, and in ductility to platinum. It excels all other metals as a conductor of heat and electricity. Silver melts at 963° C., and distils at a much higher temperature. It is rapidly volatilized when heated on charcoal by the blow-pipe flame. The metal is not oxidized by exposure to the air, neither is it affected by water, but it is blackened or tarnished by sulphuretted hydrogen. As pure silver is comparatively soft, it is usually alloyed with small amounts of copper when used for ornaments or coinage. English standard silver contains 92·5 per cent of silver and 7·5 of copper. *Silver oxide* (Ag_2O) is prepared by dissolving the metal in nitric acid and precipitating with caustic soda solution. It forms a brown powder and readily gives up oxygen when heated. *Horn silver* or *silver chloride* ($AgCl$) is obtained by dissolving silver in nitric acid and adding a solution of common salt. When exposed to the light it turns a purple-black colour, hence its great use in photography. *Silver bromide* is the most sensitive of all known solids to light. It is used for coating the 'dry-plates' employed in photography. When silver is long exposed to the air, it acquires a thin coating of *silver sulphide* of a violet colour, which deprives it of its lustre. Silver sulphide occurs native as *silver-glance.* (For *silver nitrate*, see *Nitrate of Silver.*) Silver readily forms alloys with zinc, copper, lead, tin, and mercury.

The most important silver ores are: native silver, vitreous silver (or silver-glance), black silver, ruby silver, and horn silver. Native silver occurs principally in veins, traversing gneiss, clay-slate, and other palæozoic rocks, but not usually in great quantity. It often forms a natural alloy with gold. Silver-glance or *argentite* is nearly pure silver sulphide (Ag_2S); it is one of the commonest ores, occurring usually in veins with ores of lead, antimony, and zinc. Black silver, brittle silver, or *stephanite* (Ag_5SbS_4) generally occurs in granular masses of an iron-black colour. It contains silver (about 68·5 per cent) combined with antimony and sulphur and traces of iron, copper, and arsenic. It is a valuable ore, and is found in veins along with other ores of silver. The name ruby silver is given to the light-red ore *proustite* (Ag_3AsS_3), and also to the dark-red ore *pyrargyrite* (Ag_3SbS_3). These are found in various parts of Europe, but chiefly in Mexico, Peru, and the western states of America. Horn silver, or *kerargyrite* ($AgCl$), occurs in the upper parts of veins in clay-slate, and also in beds with other silver ores or with iron-ochre. It is not abundant in Europe, but occurs in large masses in Mexico and Peru. The above are the ores of silver from which silver is chiefly extracted; but argentiferous sulphides of lead and copper are also smelted for the small proportion of silver they contain.

The following are some of the most important processes by which silver is extracted from its ores: (1) *Amalgamation.* This is an old process which is still in use in various forms. The modification of the process mostly used at the present time consists of grinding the ore with water until a thick sludge is formed, which is thoroughly mixed with mercury in iron pans. The mercury dissolves any free silver present and decomposes certain compounds of silver, afterwards dissolving the freed metal. Certain chemicals are frequently added to assist the process. The amalgam is collected by washing, and the mercury is distilled off for subsequent use. (2) Certain mattes, especially those containing sulphide of copper, are sometimes roasted in the air, whereby any silver sulphide present is oxidized to silver sulphate (Ag_2SO_4). This salt is then extracted by water, and the metallic silver precipitated by the addition of scrap-iron or metallic copper. (3) Ores containing silver sulphide are usually roasted with common salt. The silver chloride thus formed is extracted with sodium thiosulphate solution, and then precipitated as silver sulphide by the addition of sodium sulphide solution. The sulphide is converted into metallic silver when heated to a high temperature. (4) At the present time modifications of the cyanide process (see *Cyaniding*; *Gold*) are very largely used for the extraction of silver, as this metal, together with many of its naturally occurring compounds, is soluble in dilute solutions of sodium or potassium cyanide. (5) All crude lead contains appreciable amounts of silver, and is usually desilverized before being placed on the market. (See *Lead*.) Obtained by any of these methods, the silver contains a small amount of base metals, and of the noble metals gold and platinum. These are removed by solution of the silver in concentrated sulphuric acid and reprecipitation with copper or by an electrolytic process.

The silver-mines of North and South America are incomparably more important than those of all the rest of the world. The Mexican mines were worked before the Spanish conquest, and up to the present their total yield has been estimated at over £700,000,000. Their production during 1921 is reported as over 64 million ounces. The western states of America are rich in silver, particularly Nevada, Arizona, California, Colorado, Idaho, Montana, New Mexico, and Utah, and the total yield of the United States in 1921 was over 50 million ounces. Silver has been found in great quantities in the west of New South Wales (Broken Hill). The output of European countries (including Britain) is also considerable.

Silver-fir, a species of fir, the *Abies pectinata*, so called from two silvery lines on the under side of the leaves. It is a native of the mountains of the middle and south of Europe, but has long been common in Britain. It grows to the height of 150 to 180 feet, forming a very fine tree. It yields resin, turpentine, tar, &c., especially the fine clear turpentine known as Strasburg turpentine. The American silver-fir, the balm of Gilead fir (*Abies balsamea*), yields the Canada-balsam used as a transparent cement, especially in microscopy.

Silver-fox, a variety of the ordinary fox (*Canis vulpes*) inhabiting northern latitudes, and distinguished by its rich and valuable fur, which is of a shining black colour, mixed in varying proportions with silvery white.

Simaruba'ceæ, a natural order of trees and shrubs, all having an intensely bitter bark, a milky juice, and pinnate leaves. The typical genus is Simarŭba. See *Bitter-ash*; *Quassia*.

Simbirsk', a former government in the Volga-Don region of Russia, bounded on the east by the Volga. It lies partly in the black-earth region, and is therefore exceedingly rich agriculturally; grain is produced, and potatoes are cultivated in enormous quantities for the production of industrial alcohol. Simbirsk is a great poultry and egg region, and is noted for horse-breeding and stock-raising generally. About 30 per cent of the area is afforested (ash, oak, elm, lime, maple, poplar, and aspen). There is a woollen industry, and flour-milling is carried on by over 2000 mills; Simbirsk is the greatest Russian centre for the distillation of industrial alcohol. A considerable hemp trade centres at Bolshe Berezniki; Syzran, Simbirsk (the capital), and Alatir are among the important towns. Area, 19,110 sq. miles; pop. 2,124,000.

Simbirsk, a town of Russia, capital of the former government of Simbirsk, on the Volga. It has an annual fair for manufactured goods, &c., and another for horses. The woollen industry is prominent. Pop. 71,000.

Simla, a town of British India, in the Punjab, chief European sanatorium and summer residence of the Viceroy. It stands 7084 feet above sea-level, on a transverse spur of the Central Himálaya, and consists of scattered bungalows and other buildings, which extend for about 6 miles along the heights, among woods of *deodar*, oak, and rhododendron. Some trade is carried on with Tibet. The temperature seldom exceeds 72° in summer, and its average for the year is about 62°. Permanent pop. about 15,000, which is more than doubled in the hot season.

Simla Hill States, a collection of twenty-three Indian native states surrounding the sanatorium of Simla; total area, 5937 sq. miles. The mountains of these states form a continuous series of ranges ascending from the low hills of Ambála to the great central chain of the Eastern Himálaya. The chief river is the Sutlej. The climate is genial, and the winters comparatively mild. Pop. 405,000.

Simnel, Lambert, English impostor, born about 1475, died 1535. He was put forward by a party of malcontent leaders of the York faction early in the reign of Henry VII. Trained to personate Edward Plantagenet, Earl of Warwick, son of the murdered Duke of Clarence, Simnel was crowned at Dublin, and landed with his followers in Lancashire. They were totally defeated near Newark, 16th June, 1487, when most of the leaders in the rebellion perished. Simnel ended his days as a scullion in the royal service.

Simon (sē-mōṇ), Jules François Suisse, French philosopher and statesman, born 1814, died 1896. In 1839 he succeeded Cousin as professor of philosophy in the Sorbonne, but lost this post in 1852 by refusing to take the oath of allegiance to Napoleon III. He strongly opposed the war with Prussia, and after the Revolution of 4th Sept., 1870, he became a member of the Provisional Government, and was Minister of Education under Thiers from 1871 to 1873. In 1875 he was elected to the Senate and to membership of the Academy. In 1876 he became leader of the Republicans, and was Minister of the Interior until 16th May, 1877, when he was dismissed by MacMahon. He afterwards edited the *Echo Universel*. His chief works include: *Le Devoir, La Liberté de conscience* (1859), *L'Ouvrière* (1863), and *L'École* (1864).

Simon'ides of Amorgos, Greek iambic poet, flourished in the middle of the seventh century B.C. He is frequently confused, by the learned and the unlearned alike, with the greater poet *Simonides of Ceos* (q.v.). Simonides of Amorgos was born in Samos, and owed his surname to the fact that he founded a colony in Amorgos. He is believed to have written elegies, but is primarily an iambic poet. His extant fragments are written in pure Ionic, and are all of a satirical nature. The best known of his poems is his *Pedigree of Women*, an ungallant poem of 119 lines, in which he describes ten different types of women, these types being derived from the swine, the fox, the dog, the earth, the sea, the ass, the weasel, the horse, the ape, and the bee. 'The bee' is the only type which makes a good wife. This poem is extraordinarily vigorous and direct, and is an admirable piece of work, even though it makes out that 90 per cent of women are undesirable. Simonides of Amorgos was one of the earliest writers to satirize whole classes, instead of individuals.

Simonides of Ceos, Greek lyric poet, was born about 556 B.C., and died about 467 B.C. He soon left his native island of Ceos, and went to Athens, where he lived at the court of Hipparchus. When Hipparchus was murdered (514 B.C.) Simonides withdrew to Thessaly, where he was patronized by two noble families. He returned to Athens after the battle of Marathon, but soon went to the court of Hiero in Sicily, where he died at a great age.

Simonides was a professional poet, and was accused by many later writers of writing for hire. He was prolific, popular, wealthy, and avaricious. He wrote poetry of all kinds—elegies, lyrics, and epigrams—but is most famous for his epitaphs, especially for that on the Spartans at Thermopylæ, "O passer-by, tell the Lacedæmonians that we lie here obeying their orders", unmatched in its proud simplicity. The most beautiful of Simonides's fragments is his *Lament of Danaë*, a perfect piece of poetry. In some of his official poems Simonides praised his unworthy patron not by flattery, but by depreciating the standard of morality. Simonides was a scholarly poet, and was credited with inventing the different symbols for long and short *e* and *o*. He was the author of many epigrammatic sayings, of which the most famous is "Poetry is vocal painting, as painting is silent poetry".

Simon Magus, magician, religious leader, and impostor, mentioned in the *Acts of the Apostles*, viii, 9–24. He was a native of Samaria, and pretended to be an *æon* of an exalted nature, and called himself the supreme power of God. Baptized by Philip the deacon, and struck with astonishment at the miracles of the Apostles, and at the effect which followed the imposition of hands, he offered the Apostles Peter and John a sum of money to be endued with similar powers. His proposal was indignantly refused by Peter, and from Simon's attempt to traffic with money in spiritual endowments the term *Simony* has been derived. A cycle of legends concerning the doings of Simon Magus in Rome grew up in the second century, and Justin Martyr confused him with an old Sabine deity, *Semo Sancus*.

Simonoseki, a seaport of Honshu, Japan, on the Inland Sea, served by rail to Tokyo. It is a great commercial centre. Pop. 70,000.

Si'mony, in English ecclesiastical law, is the offence committed by a person who, in return for a reward, agrees to present a particular individual to a benefice. Simony was punishable under the canon law, and in the reign of Elizabeth it was further struck at by statute. Simoniacal presentations were declared to be void; both the person offering the reward and the person taking it were to be mulcted in double the profits of one year; and if the presentee had accepted the benefice he was to forfeit it and be for ever precluded from holding it. An obligation by an incumbent, however, to resign his benefice in favour of a relative of the patron if and when called upon to do so is not Simony and is not invalid.—Cf. A. J. Maclean, article in Hastings's *Encyclopædia of Religion and Ethics*.

Simplon (It. *Sempione*). See *Alps*.

Simpson, Sir James Young, Scottish physician, born 1811, died 1870. He was appointed professor of medicine and midwifery at Edinburgh in 1840. He was the discoverer of the anæsthetic properties of chloroform, the value of which in surgical and obstetrical cases he advocated strongly in a paper read before the Medico-Chirurgical Society of Edinburgh in 1847. In 1853 he was elected a foreign associate of the Academy of Medicine of Paris, and in 1856 he received the laureateship and gold medal of the French Academy of Sciences, with the Monthyon prize of 2000 francs awarded for 'most important services done to humanity'. For twenty years he devoted himself to the promotion of hospital reform. In 1847 he was appointed a physician to Queen Victoria, and in 1866 a baronetcy was conferred on him.

Simpson's Rule, first published by the English mathematician Thomas Simpson (1710–61) in his *Mathematical Dissertations* (1743), is a formula giving the approximate value of an area or volume in terms of a limited number of data. Let a plane figure be bounded by a base line, two lines (ordinates) perpendicular to the base at its extremities, and a curve which is cut in one point only by any ordinate to the base. Let the base be divided into any *even* number of equal parts, and let ordinates be drawn to the bounding curve at the points of division; there will thus be an *odd* number of ordinates in all, the end ordinates being included. Counting from one end, we may call the ordinates in order $u_1, u_2, u_3, u_4, \ldots, u_n$. If the breadth of a strip, i.e. the distance between consecutive ordinates, is h, then Simpson's rule is that

$$\text{Area} = \tfrac{1}{3}h\{u_1 + u_n + 2(u_3 + u_5 + \ldots + u_{n-2}) \\ + 4(u_2 + u_4 + \ldots + u_{n-1})\};$$

the factor in brackets being usually memorized as 'sum of end-ordinates + twice sum of other odd ordinates + four times sum of even ordinates'.

The same rule can be applied to find the volume of a long solid of variable section, lengths of ordinates being replaced by areas of sections.

To prove the rule, take three ordinates at $x = -h, 0, h$; and suppose the equation of the curve to be $y = a + bx + cx^2 + dx^3$; then $u_2 = a$, $u_1 = a - bh + ch^2 - dh^3$, $u_3 = a + bh + ch^2 + dh^3$; and area = integral of ydx $= \left| ax + \tfrac{1}{2}bx^2 + \tfrac{1}{3}cx^3 + \tfrac{1}{4}dx^4 \right|$, between limits $-h$ and h, $= 2(ah + \tfrac{1}{3}ch^3) = \tfrac{1}{3}h(6a + 2ch^2) = \tfrac{1}{3}h(u_1 + u_3 + 4u_2)$. The general form of the rule is proved by applying the result for this special case to the strips between u_1 and u_3, u_3 and u_5, &c., and adding. It should be observed that the cubic function of x, which has been supposed to represent the ordinate y with sufficient approximation between the ordinates u_1 and u_3, need not have the same coefficients a, b, c, d between the other pairs of consecutive odd ordinates, such as u_3 and u_5.

Sims, George Robert, British author and journalist, born in 1847, died in 1922. For many years he contributed a weekly article (*Mustard and Cress*) to the *Referee*, under the pen-name of Dagonet. He did a good deal towards directing the attention of the public to the question of the housing of the poor. Among his numerous works are: *How the Poor Live*, *The Dagonet Ballads*, and *My Life*. Of his stage productions may be mentioned, *Lights o' London* and *Faust Up-to-date*.

Simson, Robert, Scottish mathematician, was born in 1687, died 1768. He was educated at the University of Glasgow, and became professor of mathematics there in 1711. He published critical editions of several Greek works on geometry, but is chiefly known as the translator and editor of Euclid's *Elements*. Simson's Euclid was the standard English textbook for many years. *Simson's line*, in geometry, is a straight line which was proved by Wallace to pass through the feet of the perpendiculars on the sides of any triangle from a point on its circumcircle.

Sinai, a peninsula at the head of the Red Sea, a political part of Egypt. It is triangular in shape, and bounded by the Gulfs of Akaba and Suez and the Mediterranean. Sinai is mentioned in Scripture as the mount in Arabia Petræa where God gave the Ten Commandments to Israel. During the European War (q.v.) Sinai was the scene of successful British operations subsequent to the evacuation of Gallipoli. The battle of Rafa (9th Jan., 1917), by which it was freed from the Turk, paved the way for the conquest of Palestine.

Sinalo'a, a maritime state of Western Mexico. It is traversed by the Sierra Madre Orientale; produces gold, silver, and lead, and sugar-cane, tobacco, cotton, grain, and rubber. Culiacan is the capital. Area, 27,557 sq. miles; pop. about 340,000.

Sinclair, Sir John, Bart., British politician and agriculturist, born 1754, died 1835. In 1790 he conceived the idea of that great national undertaking, the *Statistical Account of Scotland*, a statistical and descriptive account of the whole country, parish by parish. After unwearied exertions, the work was completed in 1798. Sinclair's other publications include his *Code of Agriculture*, a work which went through several editions and translations. See *Raspe*.

Sind, a province of India, in the northern part of the Presidency of Bombay. It consists of the lower valley and delta of the Indus, and is divided into five districts, Hyderabad, Karáchi, Sukkur, Thar and Parkar, Larkana and Upper Sind Frontier, and also includes the native state of Khairpur (6100 sq. miles). The chief city and port is Karáchi; Hyderabad, Khairpur (capital of Khairpur state), Keti (a port on the principal mouth of the Indus), Sukkur, Tando Adam, and Larkana (district head-quarters) are other important towns. Area, 53,116 sq. miles; pop. 3,500,000. See *Bombay*, &c.

Singapore, a British island and seaport-city of Malaya, the chief of the Straits Settlements. The island has an area of 217 sq. miles, and lies at the foot of the Malay Peninsula, from which it is separated by a strait ¾ mile wide. The city occupies the south-eastern extremity of the island, and is the seat of government, the terminus of the railway to Woodlands (Johore Straits), and has extensive overland and deep-sea cable communications. There is a wireless station at Paya Lebar, and a naval installation at Seletar. It is at Singapore that East actually meets West, and an enormous transit trade is in the hands of a very cosmopolitan population.

Pop. (island), 424,000. The Cocos Islands, Christmas Island, and Labuan are dependencies.

Singing is the controlled use of the voice for a musical purpose. Like the related faculty of speech, the power to sing is present normally in every human being, and is generally made use of, outside the ranks of studied vocalists, in response to an instinctive desire for self-expression. This need for the utterance of significant sounds is a part of man's original equipment, and there is no reason to doubt that the result of his first efforts at sound-making, in the infancy of the race, would be more truly classified under song than under speech. From this it would seem to follow that singing must be easy, but this is so far from being the case that singing is really one of the most difficult of all the arts; nor is there any art about which ' doctors differ ' more profoundly. This state of matters is no doubt due to the fact that the processes of tone-production in singing are, from the physiological point of view, exceedingly complicated. It might have been thought that the invention by Manuel Garcia, in 1854, of the laryngoscope, which enables the actual behaviour of the vocal cords to be observed, would have done something to lessen the prevailing confusion, but instead the whole matter is tending to become more confused. Even the function of the vocal cords is now a subject of dispute. In 1909 a considerable sensation was made in the singing world by the appearance of a book called *Science and Singing* (renamed *The Voice Beautiful* in its third edition) by Ernest G. White, which denied that the vocal cords take any part in the actual production of tone, asserting that they are concerned solely with the control of breath emission, and that the tone is both made and multiplied in the head cavities.

The average compass of the voice is about one and a half octaves, and any ordinary choir of mixed voices will offer, between the lowest notes of the bass and the highest notes of the soprano, a range of about three octaves and three notes. The difference in pitch between adjacent classes of voices in the usual succession of bass, tenor, contralto, soprano is roughly half an octave. Exceptional voices are almost invariably characterized not only by special beauty of quality, but also by exceptional range. Such singers as Jenny Lind and Adelina Patti had a working range of nearly two and a half octaves, extending to E and F *in altissimo*; but an Italian singer, Lucrezia Agujari, more commonly known in her day as *La Bastardina*, had a still larger range. Mozart has noted down a cadenza which she sang in his presence, and it extends from middle C to the C *in altissimo*, three octaves above. At the other end of the scale come the remarkably deep bass voices which are specially associated with Russia. They are able to descend an octave below the bass stave in exceptional cases, and the fact that they are much less rare in Russia than elsewhere is illustrated by the special nature of the writing for bass voices in Russian choral music.

Singing Flames, Jets, and Arcs. *Flames.*—When a long glass tube, open at both ends, is lowered over a small gas flame, and the flame is well enclosed by the tube, the air in the tube is set into vibration, and the tube sounds its fundamental tone continuously. It can be shown that the flame also is disturbed and is vibrating in resonance with the note of the tube. *Jets.*—When a jet of water issues from a narrow nozzle, the column of water is unstable; necks or waists are formed on the jet, and these develop as the jet moves on, and ultimately break the jet into drops. The regular fall of the drops on a membrane gives rise to a tone of which the pitch is roughly proportional to the head of water employed. If vibrations of corresponding rapidity are impressed on a vertical jet at the nozzle, and the water falls on a small membrane placed at a distance below the nozzle, the membrane emits the impressed note in increased volume. The membrane is usually fitted on the end of a narrow piece of glass tubing. Chichester Bell has employed this device to obtain high magnification of the tune from a musical box and the ticking of a watch. *Arcs.*—The continuous-current electric arc, when shunted by a circuit which contains a self-inductance coil and a condenser, emits a musical sound the pitch of which is dependent on the inductance of the coil and capacity of the condenser. The effect may be compared with the corresponding acoustic effect of employing a steady air current to cause vibrations in an organ pipe; it was first observed by Duddell and by Elihu Thompson in 1900. It is enhanced if the arc is enclosed in coal-gas or hydrogen; this device is employed in Poulsen's method of transmitting wireless signals.

Sinking Fund. (*a*) *Actuarial Practice.*—It is customary in industry for manufacturers to set aside a certain sum out of earnings to make good, either annually or at the end of a period of years, the wear and tear of their plant, machinery, and other physical assets. In addition to provision for this form of depreciation, allowance has often to be made for ' obsolescence ' which may arise through the discovery of some better machine, &c., for doing the same work. A reserve fund is accumulated sufficient to maintain depreciation rates at the normal level and to provide for special classes of losses not covered by outside insurance. Not infrequently, in addition to this, firms write off each year out of profits a certain proportion of their fixed assets until finally they stand at ' nil ' in the books of the concern.

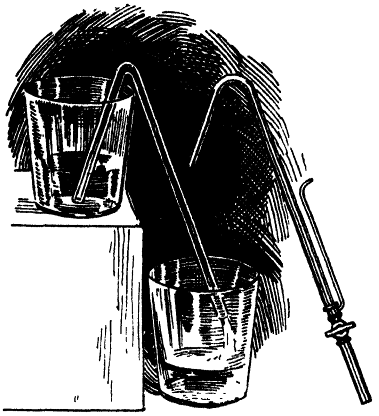
(*b*) *Government Finance.*—The motives which lead to the establishment of sinking funds in Government finance are somewhat different from those obtaining in industry. In so far as the debt has been incurred for 'productive' purposes, e.g. for building a railway, the principle is substantially identical, but the greater part of the public debts of most States has been incurred for so-called 'unproductive' purposes, generally for wars. The interest on this debt must be met out of taxation, and constitutes a fixed charge on the revenue of the State. The borrowing power of a State is often affected by the size of its existing debt, while the mortgaging of revenue to pay interest may compel expenditure on vital national requirements to be restricted. Should prices fall subsequently, moreover, the burden of fixed interest payments falls more heavily upon the taxpayer. Hence the reduction of national debt in normal times is a matter of great importance. The sinking fund was the chief method adopted in Great Britain before the European War. Each year the Budget estimates contained a fixed sum, in addition to that required for the payment of interest, to be used in buying up and cancelling debt. This method is only applicable when the selling value of the debt stands at or below par. To buy stock at, say, 110, in order to redeem a capital liability of £100, would be a costly method of redeeming debt. When a stock stands above par it may be possible, in the absence of any undertaking to the contrary, to convert the loan to a lower rate of interest, as was done in the case of Consols in 1888. Once the debt is below par the redemption of a given quantity by purchase on the market reduces the capital liability by more than the sum expended. The essence of the system consists in raising the money for the sinking fund out of ordinary revenue, and in allotting a definite amount to this purpose in the Budget.

Sinningia, a genus of Brazilian herbs, order Gesneraceæ. *S. speciosa* and others are the familiar 'gloxinias' of our greenhouses.

Sinus, in anatomy, a term applied to cavities in certain bones of the head and face, and also to certain venous canals into which a number of vessels empty themselves. In surgery, a sinus is an unnatural suppurating canal which opens externally. When it communicates internally with one of the normal canals or cavities of the body, it is usually termed *fistula.*

Sioux (sö), or **Dakota Indians**, a North American family of Indian tribes dwelling chiefly in South Dakota and Nebraska, and originally extending from Lake Winnipeg on the north to the Arkansas River on the south.

Siphon, a bent pipe used to transfer liquid to a lower level over an obstruction or over the edge of a containing vessel. The outer end of the pipe must be kept at a lower level than the end which is inserted in the liquid. To start the flow the air may be extracted from the pipe by means of an exhaust tube attached to its outer end, but an equally effective method is to fill the pipe with liquid and then keep the lower outer end stopped until the inner end has been placed in position. The height of the bend of the siphon above the liquid must be less than the height of a column of the liquid which will give a pressure equal to that of the atmosphere.



Siphons

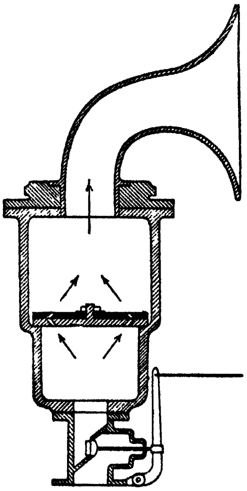
Siphon, the name applied in zoology to the tubes through which water has egress from, and ingress to, the respiratory or breathing organs of certain univalve and bivalve mollusca.

Siphonales, a large family of Green Algæ, distinguished by the partial (Siphonocladeæ) or entire (Siphoneæ) absence of septa (cross-walls) in their usually filamentous thalli. They are mostly marine, and flourish chiefly in sheltered and warm waters. Representative genera: (Siphoneæ) Caulerpa, Acetabularia, Halimeda, Vaucheria; (Siphonocladeæ) Cladophora, Struvea.

Siphonoph'ora, an order of Hydrozoa including colonial or compound jelly-fishes. They are to be found swimming or floating in the open sea. The individual members or zooids of the colony are specialized in a great variety of ways: as floats, swimming bells, stomachs, tentacles, bearers of sex-organs, &c. Here is included the Portuguese man-of-war (Physalia), with a float attaining a length of 1 foot or more, and greatly elongated tentacular individuals studded with batteries of stinging cells. Of the smaller types Velella is the most familiar; the float is flat, and provided with a triangular projection that serves as a sail.

Siren, or **Mud-eel**, a genus of amphibian vertebrates, belonging to the perennibranchiate section of the order Urodela. The *Siren lacertina* of North America is the familiar species. It is dark-brown in colour, and has two front limbs, each with four toes. The average length is about 3 feet. It inhabits the rice swamps of South Carolina, and feeds upon worms and insects.

Siren, an instrument which produces a musical sound by means of a series of puffs of air. In its simplest form (Seebeck's) it consists of a disc provided with holes at equal distances round the edge. A blast of air from bellows is directed on to the holes, and on the disc being rapidly rotated a musical sound is heard, the pitch of which depends on the number of puffs of air passing through the disc per second. In the siren of Cagniard de la Tour, the air passes by oblique perforations through the top of an air-box, and then through a finely pivoted disc by means of contrary perforations. The disc thus acts as a small air turbine, and a gear connects it to a dial which registers the number of revolutions made by the disc. The apparatus can therefore be employed to measure the frequency of a musical note. The siren was so named by de la Tour because it could be made to yield sound under water when driven by water. Modifications have been introduced by Dove, König, and Helmholtz. The siren is used on board ship in the form of a steam whistle.

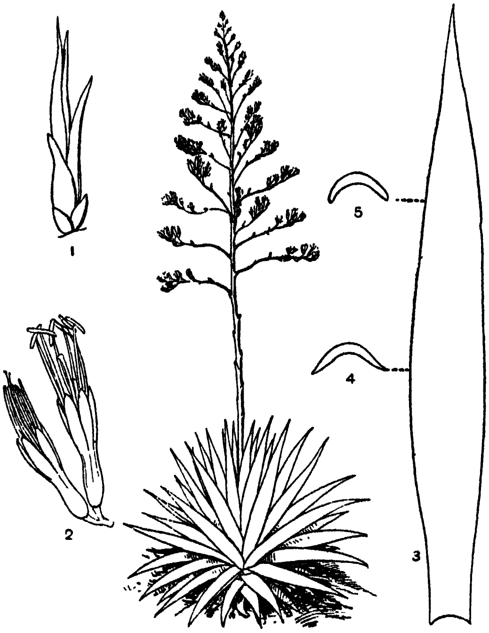


Vertical Section of a Siren

Sirens, in Greek mythology, sea nymphs who by their singing fascinated those who sailed by their island and then destroyed them. When Odysseus approached their island, he took the precaution of stuffing the ears of his companions with wax, while he bound himself to the mast, and so they escaped. The Sirens, being vanquished in music by Orpheus, threw themselves into the sea, and became formidable rocks.

Sirius, the brightest star in the heavens, also called the Dog-star, situated in the constellation Canis Major, or the Greater Dog. It is about twice as far away as Alpha Centauri, generally assumed as the nearest fixed star, and its light takes about 8·7 years to reach us. Sirius is estimated to emit thirty times as much light as the sun.

Sisal′, or Grass Hemp, a species of agave yielding a valuable fibre, a native of Mexico, Honduras, Central America, and specially cultivated in Yucatan. It is grown upon stony ground, and the leaves, from which the fibre is prepared, are between 2 and 3 feet long. See *Fibres used in Manufacture.*



Sisal (*Agave sisalana*)

1, Pole plant growing from stem. 2, Flower.
3, Leaf. 4, 5, Sections of leaf.

Siskin (*Chrysomitris spinus*), a species of European finch, the plumage of which is chiefly green with yellow patches. The chin and crown are black. These birds are usually seen in small flocks, haunting the margins of streams. The siskin inhabits Britain, and has a pleasant song. It is sometimes called the *aberdevine.*

Sismon′di, Jean Charles Léonard Simonde de, Swiss historian and political economist, born 1773, died 1842. In 1793 the overthrow of the Government compelled him to flee with his father to England. His first published work appeared in 1801, and was entitled *Tableau de l'agriculture Toscane.* In 1807 appeared the first two volumes of his *Républiques Italiennes*, which ultimately reached sixteen volumes, and was not completed till 1818. In 1819 he commenced his *Histoire des Français*, a great work which occupied the greater part of the rest of his life. Among his other works is: *De la Littérature du midi de l'Europe* (1818).

Sisterhoods, a name given to various religious and charitable orders or associations of women. Among the more important are: (1) Sisters of

Charity (also called Grey Sisters, Daughters of Charity, Sisters of St. Vincent de Paul), a Roman Catholic order founded in 1634 at Paris by St. Vincent de Paul for the work of nursing the sick in hospitals. The sisters take simple vows of poverty, chastity, and obedience, which are annually renewed; they add a fourth vow binding themselves to serve the sick. They number about 40,000 in upwards of 2000 houses scattered over all parts of the civilized world. (2) Sisters of Charity (Irish), in no way connected with the above, founded in 1815 for the purpose of ministering to the sick and poor in hospitals, and at their own homes. (3) Little Sisters of the Poor, founded in France in 1840, now spread over the world. Their chief object is the care of the aged poor, and they beg from house to house. (4) Sisters of Mercy (Irish), founded in 1827 for carrying on works of mercy both spiritual and corporal. (5) Sisters of Mercy (Anglican), a body founded in 1845 by Dr. Pusey. There are now about 40 Anglican and 150 Roman Catholic sisterhoods in Great Britain.

Sistine Chapel, the private chapel of the Popes, in the Vatican, so called from Pope Sixtus IV, by whom it was erected in 1473. It was destined for the religious services performed during Passion Week, for which it is still chiefly used. See *Vatican*.

Sis'yphus, a mythical king of Corinth, son of Æolus and Enarete. For his wickedness he was severely punished in the nether world, being obliged to roll a heavy stone to the top of a hill, on reaching which it would always roll back again, thus rendering his punishment eternal.

Sita'pur, a district and town of India, in the United Provinces; area, 2255 sq. miles; pop. 1,140,000. Sitapur, the head-quarters of the district, is situated on the Saráyan River. Pop. 21,600.

Sivas' (ancient **Sebaste**), a town of Asia Minor, on the Kirzil Irmak. It is connected by highway with Samsun, its port on the Black Sea, and is the centre of a grain and wine trade and a woollen industry. Pop. about 65,000.

Sivathe'rium, an extinct genus of ruminant animals, the fossil remains of which occur in the Pliocene Tertiary deposits of the Siwalik Hills in India. It resembled a gigantic antelope or gnu.

Siwa, an oasis of the Libyan Desert, Egypt, 30 miles long and 4 miles broad, the seat in ancient times of the oracle of Jupiter Ammon. Centrally it is occupied by a series of saline lakes and marshes, but has 200 fresh-water springs (80 fit for drinking), which are used for irrigation, &c. The climate is unhealthy. Over 9000 camel-loads of dates collected from more than 300,000 palms are exported annually; olive trees, vines, pomegranates, apricots, plums, peaches, apples, lemons, oranges, vegetables, &c., are produced, and a large salt industry is maintained. The people are divided into two sects, Senussi and Madani. They are Berbers, speaking a dialect of Tamashek, but have absorbed much negro blood. Siwa (pop. 3500) and Aghermi (pop. 700) are the only towns. Cf. C. D. Belgrave, *Siwa: The Oasis of Jupiter Ammon.*

Siwa'lik Hills, a hill range of India, in the United Provinces and the Punjab, running parallel to the Himálaya from the Ganges to the Bias; about 200 miles long; highest peaks about 3500 feet.

Sixtus V (Felix Peretti), Pope from 1585 to 1590, born 1521, died 1590. He entered the Franciscan order in 1534. In 1556 he was appointed director of the Franciscan school at Venice, and afterwards inquisitor-general. In 1570 he was created cardinal, and took the name Montalto. On Gregory's death in 1585 he was unanimously elected Pope, and immediately manifested himself an able and energetic ruler. He restored order in the States of the Church, cleared the country of bandits, regulated the finances, and re-established discipline in the religious orders. He took a part in most of the great political events then agitating Europe. He supported Henry III against the Huguenots, and Philip II against England.

Skagen, or **The Skaw**, the extreme northern point of the peninsula of Jutland, Denmark. A lighthouse, built in 1564, stands on the cape. Near it is the port of Skagen. New Skagen is a bathing-resort.

Skagerak, a broad arm of the North Sea, which passes between Scandinavia and Denmark, and with its extensions (Kattegat and the Sound) provides communication between the North Sea and the Baltic.

Skate, a name popularly applied to species of the genus of fishes Raia (see *Ray*). In the common skate (*Raia batis*) the chief portion of the body is made up of the expanded pectoral fins, which are concealed, in a manner, under the skin. The tail is long and slender. The teeth are arranged in a mosaic or pavement-like pattern. This fish, although commonly of moderate dimensions, may attain a weight of 200 lb. or more.

Skates and Skating. Skates used by early northern peoples took the form of sharp-edged bones, suitably shaped. The modern skate is a steel blade, fitted to a wooden or steel frame. Wooden-framed skates are attached to the boots by straps and screws; those of steel by spring fastenings. Speed skaters use very thin blades, slightly longer than the foot; those for figure skating are both broader and deeper, and are rounded at each end. Expert speed skaters can attain and even exceed a speed of 20 miles an hour. The rarity of very severe weather in Britain popularized for a time the use of roller-skates, with wheels in place of blades.—Biblio-

GRAPHY: Heathcote and Tebbutt, *Skating* (Badminton Library); G. A. Meagher, *Figure and Fancy Skating*; G. Wood, *Figure Skating.*

Skeat, Walter William, English philologist, born in 1835, died in 1912. He was educated at King's College School, London, and Christ's College, Cambridge. In 1878 he was elected to the Elrington and Bosworth professorship of Anglo-Saxon at Cambridge. Skeat was a most successful editor of Early English literature, and had a profound knowledge of the etymology and history of the English tongue. His chief works include editions of *The Vision of William concerning Piers the Plowman*, *Piers the Plowman's Crede*, *The Lay of Havelok the Dane*, Barbour's *Bruce*, &c., for the Early English Text Society. His principal work, however, is his *Concise Etymological Dictionary.*

Skeleton, the name applied specially to the hard structures, mostly of bony or osseous nature, which form the internal axis or support of the soft parts in the higher or vertebrate animals. The parts of the endoskeleton (q.v.) may generally be grouped under the two heads of the spinal or *axial* skeleton, and the *appendicular* parts. The former includes the skeleton of the head and trunk, the latter that of the limbs. The spinal skeleton involves the consideration of the *skull*; *spinal* or *vertebral column*, composed of its various *vertebræ*; and of the *thorax*, or *chest*, and *pelvis.* The scapulæ or shoulder-blades and collar-bones or *clavicles* constitute the shoulder-girdle or arch supporting the fore or upper limb, whilst the lower limb is attached to the pelvic arch or pelvis. See *Skull*; *Spine*; *Thorax*; *Rib*; *Arm*; *Hand*; *Pelvis*; *Leg*; *Foot*; &c.

Skelton, John, English poet, born about 1460, died in 1529. He studied at both Oxford and Cambridge, and from the former received the laureateship (then a degree in rhetoric). He was tutor to the Duke of York, afterwards Henry VIII; was rector of Diss and curate of Trompington in 1504, and was appointed *orator regius* to Henry VIII. His satirical attacks incurred the resentment of Wolsey, and Skelton had to take refuge in the sanctuary at Westminster, where the abbot afforded him protection until his death. His works comprise among others the drama or morality of *Magnyfycence*; a satire on Wolsey, entitled *Why come ye nat to Courte?*; *The Tunning* (that is, the brewing) *of Elynor Rummyng*, a humorous picture of low life; and *The Book of Phylyp Sparrow.*

Skene, William Forbes, Scottish archæologist, was born in 1809, and died in 1892. He was bred to the law, and became a writer to the signet. His chief works include: *The Highlanders of Scotland*; *Celtic Scotland: a History of Ancient Alban*; editions of *The Dean of Lismore's Book* and Fordun's *Chronicles of the Scottish Nation.* He was appointed Historiographer Royal for Scotland in 1881.

Skerryvore, a rock in the Inner Hebrides, Scotland, 10 miles south-west of Tiree Island, forming the extremity of a dangerous reef. In 1844 a lighthouse 158 feet high was placed there.

Ski (shē). The ski is a variety of snow-shoe of Norwegian origin. It varies, according to the height of the user, from 8 to 12 feet in length, and is from 4½ to 6 inches wide. Its thickness tapers to each end from about 1 inch immediately beneath the foot, to which it is attached by straps. The heel is rectangular, the toe pointed and upturned. The runner is provided with a staff or steering-pole. Experts attain a downhill speed of forty miles an hour; a jump of 120 feet is recorded, while leaps of 60 and 70 feet are common. Ski-ing is a national pastime in Norway, and now enjoys a vogue at Swiss resorts for winter sports.—Cf. Somerville, Rickmers, and Richardson, *Ski-running.*

Skiddaw, a mountain mass of Cumberland, England (3054 feet altitude). It is 3 miles north of Keswick.

Skien (shēn), a port of Southern Norway, on an arm of Christiania Fjord. There are pulp, chemical, cotton, paper, and other industries and manufactures. Pop. 16,300.

Skim-milk, milk from which the fat has been *skimmed.* It must not be confused with *separated milk*, produced mechanically by means of the cream-separator, a more economical method of collecting the fat for butter-making or for sale as cream. Skim-milk is produced by allowing the warm milk, fresh from the cow, to settle in shallow pans, the settling period being usually about twenty-four hours.

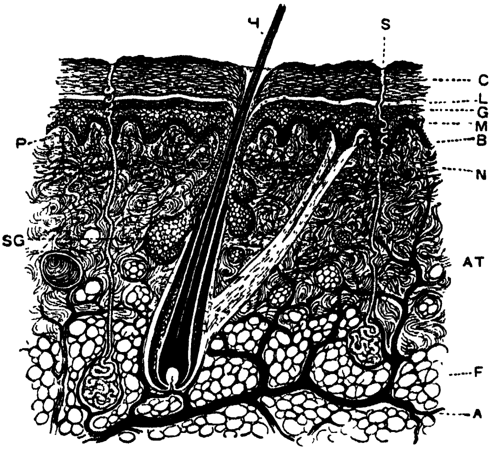
The average composition of skim milk (see similar table under *Separated Milk*) is as follows:

Water	89·85 per cent.
Fat	0·75 „
Lactose	4·60 „
Casein and albumin	4·03 „
Ash	0·77 „

Cf. *Standard Cyclopedia of Modern Agriculture* (Gresham Publishing Company).

It will be noted that the fat lost in skimming by hand is much greater, bulk for bulk, than that which remains after separation by machine. Machine separation has also the advantages that it is cleaner in operation, and does not demand the lapse of time, and the consequent deterioration of the milk components, that is a prominent characteristic of the older system.

Skin and Skin Diseases. The skin is the external covering of the body. It is made up of the epidermis or cuticle, and the dermis (corium) or true skin. The epidermis is composed of several layers, the deepest of which (basal layer) is formed by a regular row of columnar cells which multiply, and, by their evolution as they pass to the surface, eventually form the most superficial or 'horny layer'. This is a thin but resistant structure, greatly thickened over the palms of the hands and soles of the feet. It consists of closely packed flattened cells firmly welded together, and containing keratin and a fatty substance. The surface is continually being worn away by the shedding of delicate branny scales. Immediately under the epidermis, and dovetailed into it by means of innumerable 'papillæ' each containing a capillary blood-vessel, is the corium, made up of supporting tissue, with blood-vessels, nerves, lymphatics, hair follicles, involuntary muscle fibres, sebaceous glands, sweat glands, &c. The hairs are really epidermal appendages, being formed from glove-like processes dipping down into the corium. Connective tissue fibres are predominant in the central portion of the corium, giving it a firm consistence. Below this layer are found some fat cells, and the corium passes imperceptibly into the subcutaneous tissue.



Section of the Skin

H, Hair with follicle and sebaceous gland (SG). S, Sweat-gland. C, Stratum corneum. L, Stratum lucidum. G, Stratum granulosum. M, Stratum mucosum. B, Stratum germinativum. C, L, G, M. and B make up the epidermis. N, Nerves and blood-vessels. AT, Areolar tissue of the corium. F, Fat globules. A, Artery. P, Papillæ.

Pigment, when present, is found mainly in the basal layer of the epidermis. It is a great protection against the often injurious effects of sunlight.

Functions.—1. The skin acts as a *support* for the underlying tissues, and helps to maintain the natural contours of the body. It is practically impermeable, and forms a *protection* against injury, irritants, and injurious influences of all kinds, including the action of micro-organisms.

2. An equable body temperature is maintained by the *heat-regulating* function of the skin. Loss of heat takes place by conduction, radiation, and evaporation. The epidermis is a bad conductor, but by dilatation of the minute cutaneous blood-vessels, the volume of surface blood from which radiation occurs may be increased. Sweating causes further loss from evaporation. A cold stimulus, contracting the blood-vessels, will have the opposite effect, reducing heat loss to a minimum.

3. *Excretion.*—Some waste products, including urea, are eliminated from the body in the sweat, which is constant, though it may be imperceptible. If a large surface of the skin is out of action, an undue strain is put upon the kidneys.

4. *Sensation* is very highly developed over the greater portion of the surface, tactile sense being especially acute in the finger-tips. It is probable that separate nerves exist for the senses of touch, pain, heat, cold, &c.

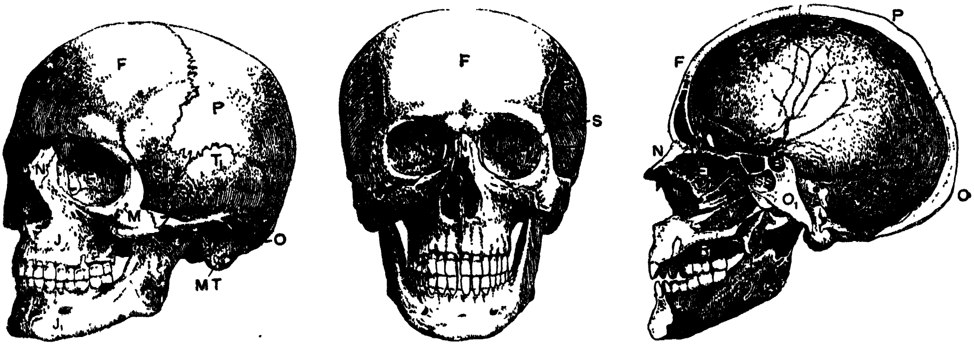
Diseases of the skin, though requiring an extensive special experience, cannot be dealt with apart from the body as a whole, and a sound knowledge of general medicine is necessary for their study. Eruptions may be composed of macules (spots), papules (raised spots), nodules, vesicles (blisters), bullæ (large blisters), pustules, scales, crusts, tumours, cysts, &c., or any combination of these. Some diseases may present themselves in infinite variety, while, on the other hand, the same clinical appearance may be produced by widely different causes. It is impossible to give a satisfactory classification of diseases of the skin.

Etiology.—Apart from predisposition, the more important causes of disease of the skin may roughly be divided into external and internal. The former include mechanical injury (e.g. friction), chemical irritants (e.g. some hair-dyes, 'developers' used in photography), physical agents (such as sunlight, X-rays, heat, &c.), animal parasites (e.g. scabies), fungi (e.g. ringworm), and insects. Micro-organisms are unable to flourish in the acid oily medium of the normal skin, but under abnormal conditions, and in association with other factors, the parasitic group is an important one. The excessive use of soap and water, by removing the natural protection, is more frequently a factor in causing skin eruptions than is generally recognized. Internal causes are too numerous to discuss. They include eruptive fevers (such as measles), micro-organisms, toxins or drugs circulating in the blood, general diseases, and morbid states of almost any kind. It is seldom that only one factor is responsible for a particular rash; more often there are many.

What is known as 'protein sensitization' is now believed to be the cause of some eruptions of the urticarial type, and possibly of many others. Individuals are, or become, hypersensitive to certain substances (usually proteins) which are capable of causing symptoms even when in minute quantities. The more common sources from which they may be derived include: shell-fish, eggs, meats, cereals, grass pollens, plants, animal emanations, furs, and bacterial products, but the possible sources are infinite. In this way symptoms may be caused by apparently inoffensive articles which arouse no suspicion and which may long remain undetected. When the whole truth is known about causation, *diagnosis* is achieved, and *treatment* will be easy.

Skink, the common name of small lizards belonging to the genus Scincus. They have a long body entirely covered with rounded imbricate scales, and are natives of warm climates. One species, the adda (*Scincus officinālis*) used to be considered a specific for various diseases.

Skipton, an urban district and market town of Yorkshire, England, in the West Riding and in the Aire Valley. It has manufactures of cottons, woollens, and thread, and there is an ancient castle (partly restored). Pop. (1921), 12,000.



F, Frontal bone. P, Parietal. S, Sphenoid. T_1, Temporal. O, Occipital. MT, Mastoid of temporal. J, J_1, Upper and lower jaws. N, Nasal. E, Ethnoid. L, Lachrymal. Z, Zygoma. M, Malar. V, Vomer (nasal septum). T, Turbinated bones. B, Bed for pituitary gland. SS, Spheroidal sinus. A, Internal auditory meatus. O_1, Basilar process of occipital bone.

Skirret (*Sium Sisărum*), a plant belonging to the nat. ord. Umbelliferæ, sometimes cultivated in kitchen-gardens for its roots. It is a perennial plant, a native of China and Japan. The roots are composed of several prongs, about the thickness of a finger, joined together at the top.

Skittles, a favourite game in England, generally played in covered grounds called skittle-alleys. It is played with a flattish-shaped wooden ball about 1 foot in diameter, and nine skittles or wooden pins, cigar-shaped and about 1 foot high. The players try each in turn with how few casts of the ball they can knock down all the skittles. There are, however, minor variations in playing the game.

Skobelev′, Mikhail Dimitrievich, Russian soldier, born 1843, died 1882. In the Russo-Turkish War Skobelev distinguished himself at the second battle of Plevna, and also at Loftscha. In 1880 he successfully led an expedition against the Tekke Turcomans, and captured Geok Tepe (Jan., 1881).

Skua-gull (*Megalestris catarrhactes*), a powerful bird of the gull family. It is found in the Shetland Islands, the Faroe Islands, and Iceland, and displays much courage in making other birds which prey on fish disgorge their newly caught food. Smaller species are known in Britain: pomatorhine skua (*Stercorarius pomatorhinus*), Arctic skuas (*S. crepidatus* and *S. richardsoni*), and long-tailed or Buffon's skua (*S. parasiticus*).

Skull, the name applied to the skeleton of the head, composed in most vertebrates of a *facial* and a *cranial* portion, and enclosing the brain and organs of special sense. The skull of man includes twenty-two bones (see figure). At the base of the occipital bone is the large aperture termed the *forāmen magnum*, through which the brain and spinal marrow become continuous. Two lesser *foramina*, one in either orbit, transmit the optic nerves, while several others in the base of the skull transmit cranial nerves or vessels involved in the blood-supply of the brain and its coverings. The size and shape of the skull vary in the different races of man, and at different ages from infancy to old age. The skulls of most vertebrata differ widely from that of man in the relative development of their various parts. See *Ichthyology*, *Ornithology*, *Reptiles*, *Ear*, *Eye*, *Nose*, &c.

Skull-cap, a name of plants of the genus Scutellaria, order Labiatæ, so called from the peculiar shape of the upper half of the calyx. The two British species are small herbs, with blue or purple flowers, growing in wet places.

Skunk (*Mephitis mephitica*), a carnivorous animal belonging to the weasel family. It inhabits North America, though some species range farther south, and its average size is about that of a large cat. Its fur is dark brown, streaked longitudinally with black and white. The skunk is notorious for the potent and disgusting odour which it emits. The secretion of its anal glands can be forcibly ejected at will, and its stench is so persistent that no amount of washing will remove it from clothes. The skunk is largely hunted for the sake of its fur, which is purified for commercial purposes by heat.

Skunk

Sky, the arch or vault of the heavens, the hemispherical dome on which sun, moon, and stars are seen projected. The remoteness of even the nearest of the heavenly bodies makes them all seem equally distant, ordinary parallax, to which even more than to binocular vision we are probably indebted for our ability to estimate distances at the earth's surface, being entirely absent.

The blue colour of the sky was at one time thought to be simply the natural colour of the gaseous mixture which constitutes the terrestrial atmosphere. On this theory the colour should be deeper the thicker the layer of air through which the light passes, whereas in fact the colour usually deepens towards the zenith. A successful theory based on the electromagnetic theory of light has been given by Lord Rayleigh (q.v.), who attributes the observed phenomena to the dispersion of light by small particles in the atmosphere, some of these particles being probably the molecules of air themselves. Rayleigh's theory not only accounts for the blue of the zenith, it also explains the fact that the light of the sky is more or less polarized, in a plane passing through the sun, the polarization being a maximum when the direction from which the light comes is 90° from the direction of the sun.—Cf. *Philosophical Magazine*, 1881, 12, p. 81.

Skye, the largest of the Hebrides of Scotland, situated on the west of the county of Inverness, of which it forms a part, and from which it is separated by Kyle Rhea and the Sound of Sleat; greatest length, 48 miles; breadth, from 3 to 25 miles; area, about 600 sq. miles. The interior may be regarded as one great mountainous moorland, rising in Cuchullin Hills to an altitude of 3200 feet. Numerous streams and fresh-water lochs afford abundance of trout and salmon. The only arable land lies along the seaboard, and is mostly cultivated under the crofter system. Sheep and cattle are raised, and fishing and distilling are prominent occupations. Portree is the seaport and chief village, and is served by steamers to Oban and Glasgow. Pop. (1921), 11,000.

Slag, a by-product obtained during the smelting of ores in the extraction of the metals. Slags may be practically free from valuable metal, when they are known as clean slags, or may contain appreciable quantities of metal and require retreatment. Iron blast-furnace slags consist essentially of silicates of lime and alumina; slags from copper and lead smelting consist mainly of silicates of iron and lime. As a rule slag forms a molten mass in the furnace, is run off and cooled, when it forms a solid with a more or less glassy appearance. Slags are sometimes cast into blocks, and used for road-making and building; some slags, after fine grinding, are used for the manufacture of hydraulic cement, similar to Portland cement in properties and uses. Slags are also used for the manufacture of slag wool or silicate cotton (see *Mineral Wool*). *Slag phosphate meal* is a fertilizer made by finely grinding basic slag obtained in the making of steel.

Slander, in English law, is the defamation of a person by spoken words. It is distinguished from libel (q.v.) in the following respects: (1) libel is *written* defamation; (2) in general, slander does not give rise to a criminal action; and (3) in order that a civil action may lie in respect of a slander, damage must, as a rule, have been sustained and must be proved. But with regard to (2), it should be observed that slander is a crime if the words spoken be ‘ seditious, blasphemous, grossly immoral, or uttered to a magistrate in the execution of his office, or uttered as a challenge to fight a duel or with an intention to provoke the other party to send a challenge ’; and with regard to (3), it should be noted that proof of actual damage is not necessary if the slander complained of is an assertion (*a*) of incompetence or misconduct in trade or business; (*b*) of the commission of an indictable crime; (*c*) that a person is suffering from an infectious or contagious disease; or (*d*) that a woman is unchaste or has committed adultery. General terms of vulgar abuse, e.g. 'rogue', 'scoundrel', and the like, and such expressions as 'swindler', 'cheat', or 'thief', not uttered with reference to conduct in trade or business, are not actionable. Fair criticism of an author or public man, however severe it may be, is legitimate, but any criticism which is merely a pretext for calumniation is actionable.

Unless on an occasion on which the words complained of were privileged, the plaintiff need prove only that the uttering of these words is a wrong which was done intentionally and without just cause or excuse; but if the occasion was a privileged one, he must also prove that the words were uttered maliciously, i.e. with deliberate animosity or utter disregard of the consequences. Communications are *prima facie* privileged when made in pursuance of a duty or interest to a person who has a corresponding duty or interest; and the duty may be moral, social, or legal. In such cases evidence of express malice is necessary if the plaintiff is to succeed in his action. A further defence to an action for slander is *veritas*, i.e. that the words complained of are true; for any person may lawfully make a statement which is true. A person who repeats a slanderous statement uttered by another is liable in damages equally with that other. It is no defence that the statement was repeated merely as a rumour.

An action of damages cannot be brought after two years from the date of the slander or, if special damage has been suffered, after two years from the occurrence of such damage. The courts will not readily grant an injunction against the repetition of a slander unless they are clearly satisfied of its untruth and the probability of it leading to injury to trade or business.

In Scots law there is no distinction between libel and slander. In other respects, also, the law of Scotland differs from that of England. Thus, for example, there is no remedy by way of criminal proceedings; imputations against morality, whether of a man or of a woman, are actionable; and damages may be given as solatium for wounded feelings or physical suffering though no pecuniary loss has been sustained.

Slate, or Clay-slate, called sometimes *argillite*, a well-known hard variety of rock which splits into thin plates, the type being roofing slate. The lamination of slate is not that of its bedding, but is often at right angles to it. It is produced by lateral pressure, and slate is thus a disturbed and metamorphosed rock. The minute platy particles of shale, notably micas, become arranged by pressure with their broader surfaces parallel with one another, and even grow under these conditions, imparting a *cleavage* to the mass, whereby it becomes a fissile slate. The prevailing colour of slate is grey, of various shades; it yields to the knife, but varies considerably as respects hardness in its different varieties. From the natural divisions of the rock, slate often forms peaked and serrated mountains. The finest variety, which is used for the covering of roofs, is generally embedded in other slate rocks of a coarser kind. Quarries of slate of this description are worked extensively in Carnarvon, Merioneth, Argyll, Lancashire, Cornwall, Perth, and Cumberland; also in various localities in the United States. Those slates which contain a large proportion of quartz are called *whet-slate*. The most valuable kinds come from Sonnenberg, in Meiningen, and Saalfeld. *Drawing slate*, or *black chalk*, is slate containing 8 to 10 per cent of carbonaceous matter. It comes from Italy, Spain, and Bayreuth. *Polishing slate*, which is composed of the siliceous skeletons of infusoria, occurs at Planitz, near Zwickau, and near Bilin, in Bohemia. It is used for polishing metals. *Slate-pencils* are made of certain varieties of soft slate.

Slater, the popular north-country name of two families of Isopod crustacea: (1) sea slaters (Ligiidæ), of which one species (*Ligia oceanica*) is common on rocky shores; (2) land slaters or wood-lice (Oniscidæ). One species (*Porcellio scaber*) is commonly found beneath stones, among damp moss, and in similar situations. The colour is a dull leaden hue, which sometimes exhibits white spots. *Oniscus asellus* is another familiar species, and is spotted yellow and white. The slaty-blue *Armadillo vulgaris* rolls into a ball when disturbed, hence the American name of 'pill bug'. The water slaters, genus Asellus, are found in fresh-water streams and ponds. Wood-lice were formerly used for medicinal purposes.

Slatin, Sir Rudolf von (Slatin Pasha), Anglo-Austrian soldier and administrator, born, near Vienna, 1857. At the age of seventeen his long association with the Anglo-Egyptian Sudan began, and in 1879, through the influence of Emin Pasha, General Gordon made him a *mudir*, and later (1881) Governor-General of Darfur. During the Mahdist rising he surrendered to Mahomet Ahmed after winning twenty-seven battles, and he was taken in chains to Khartum, where, after the fall, the reeking head of 'Chinese Gordon' was produced for his inspection. After eleven years he was enabled to escape (1895), reached Egypt, was made Pasha by the Khedive, and received the C.B. For his services in the Sudanese campaign

(1897–8) he received the K.C.M.G., and in 1899 he was made a baron of the Austrian Empire and became Inspector-General of the Sudan. Both Houses of the British Parliament expressed the national thanks. Slatin Pasha had been created G.C.V.O. in 1912, and in 1914 he was on leave in Austria. The outbreak of war shattered the historic link between the nations, and Slatin Pasha resigned, his place remaining vacant. His work as head of the Austrian Red Cross during the European War and his kindly influence on the treatment of Allied prisoners were characteristic of the man.

Slaughter-houses, Public, or Abattoirs, have been known since the comparatively early days of Rome, where, after a period during which animals were slaughtered in an open space, a special building was erected for the purpose. In mediæval Germany slaughter-houses were, when possible, placed on the banks of rivers. The first Napoleon provided Paris with slaughter-houses, and in the suburb of La Villette that city now possesses one of the finest in existence; its entrance-gates are flanked by handsome groups of statuary, and its courts and buildings accommodate 1200 butchers. Immediately adjacent is an extensive cattle-market, an arrangement always desirable. In England the Public Health Act of 1848 provided for the erection of public slaughter-houses by local authorities, and the dark and insanitary dens once found in the rear of butchers' shops are now practically non-existent. A public slaughter-house should stand outside a town and be approached by a road wide enough to avoid congestion of traffic by the slow passage of animals. It should also be served by a branch railway line. The slaughtering-chamber should be so arranged that animals entering it, or awaiting entrance, see neither the process of slaughtering nor the dead carcasses. Inquiry has lately been made as to the most humane and satisfactory instruments of slaughter. The Greener patent killer, the Blitz, and other instruments all have their advocates; but many experts still prefer the pole-axing of cattle, followed by 'pithing' or severance of the spinal cord.—Cf. R. S. Ayling, *Public Abattoirs: their Planning, &c.*

Slave Coast, a maritime strip in the west of Africa, on the Guinea Coast, extending between the Volta and the Benin, a stretch of about 240 miles. It is divided between Britain (Southern Nigeria) and France (Dahomey).

Slavery and the Slave Trade. The institution of slavery is found throughout the records of ancient times. The Mosaic Law contains rules and regulations for the treatment of Jewish slaves, and discriminates between slaves of foreign or conquered races and Hebrew slaves who, through debt or crime, had lost their status of freemen; the latter might not be kept in bondage for more than seven consecutive years. Greek civilization was based upon slavery, and Aristotle defended the practice on the ground that some men were 'slaves by nature' and could be happy and useful only in a condition of dependence. Slaves of Greek blood had special privileges, but, at all events in Athens, other slaves were not cruelly treated, and instances of manumission were frequent. In Rome the treatment of slaves was much more severe, and in early times there was no limit to the power of the master. The formidable revolt of the slaves under Spartacus (about 73 B.C.), which has bestowed its name upon a modern movement, was the result of the inhumanity with which slaves were treated under the Republic. In the days of the Empire, when slaves were very numerous, their condition improved, and the growth of trade, in which they were employed, led to a practice of permitting a slave to retain a proportion of his earnings (his *peculium*), frequently employed for the purchase of his freedom. The rise of Christianity did not put an end to slavery, for St. Paul sent his slave friend Onesimus back to his master, Philemon, and the Christian teachers could not hope to upset the foundations of the existing social system. But the influence of Christianity gradually improved the lot of the slaves, and was connected with the development in Western Europe of slavery into the mediæval system of serfdom or villeinage (see *Serfs and Villeins*). There were, however, in the Middle Ages, and up to the eighteenth century, considerable numbers of Christian slaves in Mahommedan countries, either prisoners of war or captives taken by the pirates who infested the Mediterranean.

The discovery of the New World marks a new era in the history of slavery. In order to exploit the riches of the American continent, the European nations introduced large numbers of negro slaves captured or purchased in Africa, and the slave trade became an important branch of maritime commerce. The supply of slaves was so large that the traders were not restrained by economic considerations in the arrangements made for their transport to America and the West Indies, and the story of the slave trade is perhaps the most shameful chapter in modern history. English merchants took a very large share in the trade, and it became a source of wealth to both Bristol and Liverpool. The condition of the slaves in the colonies or plantations varied with local circumstances, and depended primarily upon the character of the master or overseer. Parliament, by legislating for the treatment of slaves, legalized the institution, and until the reign of George III colonists used to bring slaves to Britain as personal attendants, although there was considerable doubt as to whether a slave was not emancipated by being brought to this country. The doubt was settled by Lord Mansfield's decision, in 1772, that a slave who was brought to England was free while he remained in the country, and a similar decision was given in Scotland in 1775. Meanwhile there was a growing feeling of horror at the abominations of the slave trade, and a society for its suppression was founded in 1787 by Thomas Clarkson and William Wilberforce. The latter was an intimate friend of William Pitt, and he persuaded him to appoint a committee to inquire into the conditions under which negroes were carried in the slave ships. The result of the inquiry was appalling, and though many of Pitt's supporters were interested in maintaining the trade, he at once passed some restrictions upon it and promised that the whole subject should be considered. A Bill for the abolition of the trade was rejected in 1789, but in 1792 Wilberforce carried in the House of Commons a motion which contemplated a gradual suppression within four years. The Lords did not accept the motion, and the outbreak of the French war distracted public attention, but Wilberforce persevered in bringing the question before Parliament, and in 1805–6 his efforts were rewarded by a prohibition of the trade in the colonies conquered from the Dutch. In 1807 the slave trade was made illegal by Act of Parliament, but in 1811 the law had to be strengthened by a subsequent enactment substituting imprisonment and transportation for the pecuniary penalties of the original Act. The example set by Great Britain was followed by the United States (1808), by France at the end of the war, and subsequently by all civilized countries, and the trade with America and the West Indies was suppressed in the first half of the nineteenth century.

Clarkson and Wilberforce next directed their energies to the emancipation of the existing slaves in the British possessions, and, along with Sir Thomas Fowell Buxton and Zachary Macaulay (the father of Lord Macaulay), they founded in 1823 an Anti-Slavery Society to concentrate the efforts of reformers who had long been working for this end. Ten years later the Emancipation Act of 1833 provided for the abolition of slavery throughout the British Empire from 1st Aug., 1834, though the slaves had to serve their old masters as apprenticed labourers until 1838. A sum of £20,000,000 was given in compensation to the slave-owners. France took a similar step in 1848, Holland in 1863, and the revolt of the Spanish colonies in South America and the creation of new republics was accompanied by the abolition of slavery, which found its last stronghold, except for Brazil, in the United States of America.

Many of the Northern States gradually emancipated their slaves in the first forty years of the nineteenth century, and there was a strong feeling against the institution. But the dependence of the Southern States upon slave labour created such large vested interests that slavery continued to be maintained and defended, and in 1860 there were nearly four millions of slaves in the South. Many abolition societies were in existence in the North, and ecclesiastical and other organizations protested against the continuance of slavery, but the Federal Constitution of the United States restricted the operation of public opinion, many of those who detested slavery feeling that it was a matter constitutionally within the rights of individual states. In the middle of the nineteenth century a bitter feeling developed between North and South, and the publication of Mrs. Beecher Stowe's *Uncle Tom's Cabin* in 1851 and of other anti-slavery writings, accentuated the repugnance of the North to the conditions existing in the South. It is, however, doubtful whether the Northern abolitionists would have attempted any actual interference with the South if the Southern States, resenting the election to the presidency of so strong an abolitionist as Abraham Lincoln, had not created a new issue—that of the right of secession from the Federation. The outbreak of war to prevent secession placed the Northern abolitionists in a stronger position, and after the victory of the North in the Civil War of 1861–5 the Southern states were readmitted to the Union on condition of the cessation of slavery, which was forbidden by amendments made in the Constitution. Brazil did not abolish slavery until 1888, and it still exists in a greater or less degree in Mahommedan countries.—BIBLIOGRAPHY: A. E. Zimmern, *The Greek Commonwealth*; S. Lane Poole, *The Barbary Corsairs*; Clarkson, *History of the Slave Trade*; G. W. Williams, *History of the Negro Race in America.*

Slavonic Languages. The Slavonic languages belong to the Indo-European family, and are closely connected with the Baltic group. Eleven different Slavonic literary dialects may be enumerated: (1) Old Bulgarian (Church Slavonic), (2) New Bulgarian, (3) Serbian (Illyrian, Ragusan, Croatian), (4) Slovenian, (5) Russian, (6) (Ruthenian) Little Russian, (7) White Russian, (8) Czech or Bohemian, (9) Slovakian, (10) Polish, (11) Serbian (Upper and Lower Lusatian). The dialect in which the Old Bulgarian or Cyrillian literature is composed is now dead, although in the ritual of the Greek Church, especially among the Russians, Bulgarians, and Serbians, service books written in it are still used. The Little Russian and White Russian dialects were at one time, especially at the period of Polish domination, largely used in literary production, but the latter is now almost entirely disused for literary purposes, and the former is only used in poetry and popular tales. Colloquially both dialects are still in vigorous existence, but their affinity to the Great Russian prevents them from being employed in any considerable literary works. The Serbian and Slovenian dialects are essentially one, but have nevertheless, in consequence of political, religious, territorial, and even of alphabetical grounds of separation, produced several distinct literatures—Serbian proper, Ragusan, Croatian, and Slovenian. Slovakian has always been of less importance than Bohemian as a literary dialect. The two Lusatian dialects preserved their independence, but never, except at the Reformation epoch, attained any considerable degree of literary activity.—Cf. T. G. Tucker, *Introduction to the Natural History of Language.*

Slavonic Mythology. The derivation and historic development of the Slavonic mythology are still problems for scholars. The difficulty in solving these problems arises not so much from the want of material as from the heterogeneousness of that material. The Slavonic mythology contains elements derived from most of the Indo-European nations with which the Slavs, themselves an Indo-European people, have come into contact. Indian, Persian, Græco-Roman, Celtic, Germanic, Scandinavian, and Prusso-Lithuanian elements, and even some derived from sources outside of the Indo-European family (Finnish), can be traced in their mythology. Besides Sviatovit and the two other chief gods, Perun and Radegast, the following may be mentioned as having had a general worship paid to them: Prove, the god of justice; Rugevit, of war; Siva, or Ziva; Triglav (Trimurti); Lado and Lada, divinities of order and love; Dievana (Diana), goddess of the woods; Prija, the Scandinavian Freya (Frigga); Bjelbog, the white god; Cernobog, the black god; Morena (Marzana), goddess of death; Jutrebog, god of the morning; Vegada, the weather god; and good and bad demons—Djasi, Diesi, Biesi, Dievy, Lutice, Skrety, &c. The forms of the Slavonic deities recall to mind those of India. Sviatovit was represented as four-headed. A stone statue of him was discovered at Zbrucz, in Eastern Galicia, and has been set up at Cracow. Perun was represented as four-faced. The Slavonians are said to have believed in the immortality of the soul, and the resurrection of the dead.

Slavs, Slaves, or Slavonians, a branch of the so-called 'Alpine' or Central race which is most nearly allied in language to the Lithuanian and more distantly to the Germanic languages, spoken by the mixture of Nordic, Slav, and true Alpine peoples known as the German nation. In the fourth century Slavs lived in great numbers in the neighbourhood of the Carpathians, and thence they appear to have spread northward to the Baltic and southward to the Adriatic. About the beginning of the sixth century they are found on the northern banks of the Lower Danube, whence they passed over to the southern banks, occupying Mœsia and Thrace; at this time Slavs also peopled Bohemia and Moravia, and before the end of the century they had penetrated into Transylvania, Hungary, Upper Austria, Styria, Carinthia, and Carniola. The Slavonic tribes of Chorvatians (Croats) and Serbians settled probably between A.D. 634 and 638 in Dalmatia and the whole of ancient Illyricum (Bosnia, Serbia, and the neighbouring districts, comprising modern Yugo-Slavia). Finally, Slavonic tribes spread from their first settlements also to the north and east, over the remainder of modern Russia. Of this wide territory the Slavonians again lost in process of time the Elbe and Oder regions, Upper Austria, and part of Carinthia and Styria, of all of which they were deprived by Germanic tribes; large parts of Translyvania and Hungary, which fell to Roumanians and Magyars; and parts of the regions on the south of the Danube, which came into the hands of Greeks and Turks.

The Slavs in the districts in which they still exist form two great groups, the south-eastern and the western Slavs. The former include: (1) Russians, (2) Serbians, (3) Croats, (4) Slovenes (see *Bulgarians*); and the latter include: (1) Czechs (comprehending Czechs in the narrower application, Moravians, and Slovaks); (2) Sorbs (Lusatians), divided into Upper and Lower Sorbs; and (3) Poles. The total number of Slavs is said to be about 116,000,000, five-eighths of whom are Russians. With few exceptions the south-eastern Slavs belong to the Greek Church, the western Slavs mostly to the Roman Catholic. See *Pan-Slavism.*—BIBLIOGRAPHY: P. R. Radosavljevitch, *Who are the Slavs?*; R. J. Kerner, *Slavic Europe*; T. Florinski, *The Slavonic Race*; J. Machal, *Slavic Mythology.*

Sleep, the state in which the activity of the senses and cerebrum or brain proper appears to be naturally and temporarily suspended. This state is consistent with a kind of passive activity of these nervous centres, as seen in the acts or phenomena of dreaming, as well as in other concomitant phenomena of sleep. All parts of the body which are the seat of active change require periods of rest. In the case of the brain it would be impossible that there should be short periods of activity and repose, that is, of consciousness and unconsciousness, hence the necessity for sleep. Sleep affords the interval during which constructive changes in the brain tissues are in excess of the disruptive or exhaustive changes. The period of sleep is a period of recuperation in which the rest of the body participates indirectly. The respective influences of habit, age, temperament, and occupation have much to do with the induction and maintenance of sleep in different individuals. An abnormal condition of irritability, caused by great mental effort or strain for a considerable time, frequently results in preventing the access of sleep when it is desired. This indicates a revolt of the nervous centres, which may prove dangerous if the cause of it be not speedily done away with. Sleep often occurs in very different degrees in different parts of the nervous system. The phenomena of *dreams* and *somnambulism* are examples of differing degrees of sleep in different parts of the cerebro-spinal nervous system. Physiologists are all agreed that the dreamless sleep is the most refreshing, the lighter sleeper being liable to be disturbed by the most trifling noises. In some cases of disease sleep may be prolonged for indefinite periods, although obviously the distinction between coma and sleep is only made with great difficulty in such cases; whilst, on the contrary, periods of active wakefulness may occur and extend for days, weeks, or even months, without a single interval of sleep or repose. Insensibility is equally produced by a deficient and an excessive quantity of blood within the cranium; but it was once supposed that the latter offered the truest analogy to the normal condition of the brain in sleep, and, in the absence of any proof to the contrary, the brain was said to be during sleep *congested.* Direct experimental inquiry has led, however, to the opposite conclusion. The condition of the brain during sleep is one of considerable bloodlessness. There seems to be a diminished quantity of blood circulating through the brain, and the speed of its movement is much lessened. See *Dreams*; *Somnambulism.*

Sleeping-sickness, a fatal disease common in Central Africa. Its chief characteristics are mental and physical lethargy and an irresistible tendency to sleep, with enlarged glands, wasting of the body, and convulsions. The disease may last for a comparatively short period, or for several years, but, so far as is known, it is invariably (or almost invariably) fatal. Its cause has been traced to the presence of a parasite of the genus Trypanosōma in the cerebro-spinal fluid and the blood, communicated from one person to another by the bite of an insect, the *Glossina palpālis*, a species of tsetse fly. The disease was known a century ago among negro slaves both on the west coast of Africa and after transportation to the West Indies. In 1896 it was carried from the Congo to Uganda by the survivors of the Emin Pasha expedition who settled on the Victoria Nyanza. In 1902 the Royal Society sent out a special commission of investigation, whose work constitutes one of the romances of modern medical science. Bruce demonstrated the facts concerning the life-history of the parasite, which has its natural host in the healthy big-game of the fly-belt, and thus initiated the preventive measures which have brought about an enormous diminution in the mortality in Uganda. These consisted of the removal of the population from the fly-infested shores of Lake Victoria, and the destruction of the wild game. *Glossina morsitans* conveys *Trypanosōma brucei*, which is responsible for a Rhodesian form of the disease more rapid in its course than the Congo form. It has been estimated that between 1896 and 1906 from 400,000 to 600,000 African natives died from sleeping-sickness. There are a very few cases on record of Europeans suffering from it.

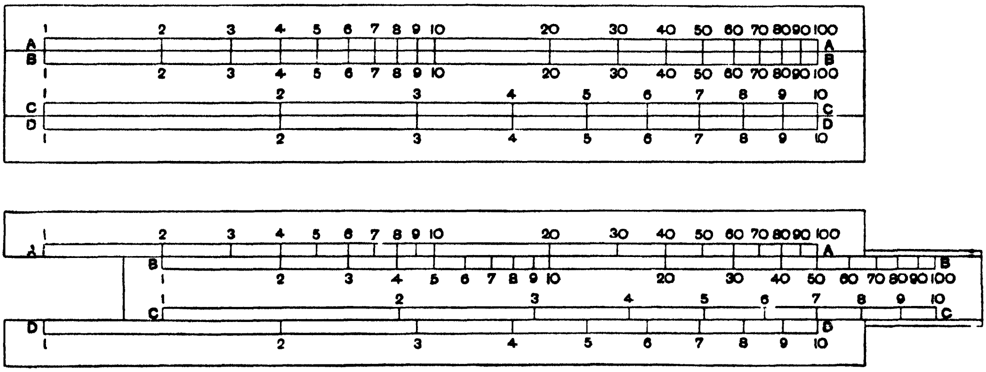
The term sleeping-sickness has also been used to denote an epidemic disease of the central nervous system to which the name *Encephalitis lethargica* was given by von Economo in 1917. In that year outbreaks occurred in Austria and France. The spread throughout Europe followed, the disease becoming severe during the winter of 1919–20. In this country, however, the case incidence did not rise until the following winter. In England and Wales the 1470 cases notified during 1921 fell in the following year to 454. *Encephalitis lethargica* may be the same disease as caused epidemics in 1712–3, 1889–90, and 1846. It is characterized by fever, which is not usually extreme, headache, lethargy which may alternate with sleeplessness, and, since any part of the nervous system may be involved, a great variety of forms of paralysis. The most fatal period of illness is early in the second week. About one quarter of the cases die.

Slesvig, a province of Denmark officially called South Jylland, and comprising the northern zone of the former Imperial Prussian province of Schleswig-Holstein (q.v.), which was partitioned after the European War. The area is about 1538 sq. miles, and the pop. (1923) 164,000.

Slide-rule, an instrument by means of which calculations involving multiplication and division can be performed mechanically and with a considerable saving in time.

The simple slide-rule has a slide which can be moved in a groove cut in the body of the rule. Scales are marked on both edges of the slide, and there are also similar ones on the rule. These scales are graduated in proportion to the logarithms of the numbers shown on them, that is, the distance from the initial point on the scale to any division is proportionate to the logarithm of the number on the scale at that point. The main divisions are subdivided to facilitate calculations with large numbers.

In the process of multiplication the logarithm of the product may be obtained by the addition of the logarithms of the figures to be multiplied. To multiply two numbers by the use of the slide-rule, the index-mark of the scale on the slide is set against the first of the figures on the scale of the rule, when the result of the multiplication is found on the scale of the rule against the second figure in the multiplication on the slide. It will be seen that in this process the distances representing the logarithms of the two numbers are added and the distance corresponding to their sum is found, but as the scale divisions are marked not with the actual logarithms but with the figures corresponding to them, the final result may be read from the scale.



Slide-Rule. In the lower figure scales A and B are set for multiplication or division by 2

Division is performed by setting the slide so that the divisor on the scale of the slide is against the dividend on the rule, when the quotient is found on the rule-scale against the index-mark of the slide. It will be noticed that in this process the distances corresponding to the two logarithms are subtracted the one from the other.

The unit length of the top scales on both slide and rule is made one-half of that of the bottom scales to facilitate the derivation of square roots and the squares of numbers. A uniformly divided scale on the back of the slide enables the user to deduce the values of the logarithms of numbers when these are required in any type of calculation. Other scales beside this one are useful in the determination of the sines and tangents of angles. A sliding runner, known as the *cursor* and usually consisting of a small metal frame with a glass window in it, which has a hair-line marked across it, facilitates the setting of the figures or graduations of the slide against those of the fixed scales.

Slide-rules for use in particular types of calculations are available, but it is questionable whether the extra scales on them are of sufficient service to compensate for the possible confusion which their presence entails.

The common slide-rules have scales 10 inches long, but they are also procurable with 5-inch or 20-inch scales. The 10-inch rule gives results to a degree of precision comparable with that of the usual measurements made in everyday practical work, and is in consequence a very useful appliance in engineering and other calculations. When a great degree of precision is required, a slide-rule with the scale in the form of a spiral on a cylindrical drum, which is known as Fuller's rule, is available. The length of scale in this case corresponds to that of a straight rule, 1000 inches or 83 feet 4 inches long.

Slide-valve. See *Valve and Valve Gear.*

Sligo, a county of Ireland, in the province of Connaught; served by the Great Southern & Western and other railways. The coast, along which are Killala and Sligo Bays, is low and sandy. The greater portion of the county gradually rises from the coast to the ridges of the Ox Mountains, whence it descends into the valleys of the Moy and other streams. The principal rivers are the Arrow, Owenmore, Easky, and Moy. There are also several lakes, having an aggregate area of 12,740 acres, and including the beautiful Lough Gill, Lough Arrow, and Lough Gara. Oats and potatoes are the chief crops; some cattle are raised. Coarse woollens and linens are manufactured for home use. The coast fisheries are extensive. Sligo is the county town; others are Collooney and Ballymote. Pop. 80,000.

Sligo, a seaport town of Ireland, the county town of Sligo, province of Connaught, at the mouth of the Garvogue, on Sligo Bay; served by the Great Southern & Western, the Midland Great Western, and the Sligo, Leitrim, & Northern Counties Railways. It is the most important seaport in the north-west of Ireland, and has a large trade, chiefly with Liverpool, Glasgow, Londonderry, and a few foreign ports. The exports consist chiefly of provisions, cattle, grain, flour, &c.; and the imports, colonial produce, timber, and coals. Pop. 12,000.

Sling-fruits, explosive fruits which when ripe throw their seeds to a distance by a sudden release of tension. The crane's-bills, touch-me-not, furze, and many Leguminosæ show the phenomenon. Wood-sorrel and violet behave somewhat similarly.

Slips, Propagation by, a mode of propagating plants, which consists in separating a young branch from the parent stock, and planting it in the ground. Slips from trees of which the wood is white and light, such as willow, poplar, or lime, succeed best. A slip succeeds more certainly when two or three young buds are left on the lower part of it underground.

Sloane, Sir Hans, English physician and naturalist, and founder of the British Museum, born in the north of Ireland in 1660, died in 1753. He studied medicine in London, Paris, and Montpellier, and in 1684 settled in London in the practice of his profession. In 1685 he was admitted a Fellow of the Royal Society, of which he was appointed secretary in 1698, and president in 1727. His *Natural History of Jamaica* (1707–25) was the result of his observations in that island during a visit in 1687–9. George I created him a baronet (1716) and physician-general to the forces (1722), and on the accession of George II he was named physician-in-ordinary to His Majesty. Sloane Square, London, is named after him. See *British Museum.*

Sloe, or **Blackthorn** (*Prunus spinosa*), a well-known deciduous shrub of the plum genus with spinose branches, and possessing a very hard, tough wood. It blossoms with white flowers in the early spring, and has a black, round, astringent fruit which is used for preserves, and for dyeing black. The sloe abounds in Britain and most parts of Europe, and is from 8 to 15 feet high. There are two or three varieties, including double-flowered, variegated-leaved, and egg-shaped fruited forms.

Sloop, a small vessel furnished with one mast and a fixed bow-sprit. It is fore-and-aft rigged, and usually carries a main-sail, fore-sail (jib-shaped), a jib, and a gaff-sail. The sloop much resembles the cutter, but the latter's bow-sprit is not fixed. See *Cutter.* A *sloop-of-war*, in the British navy, was formerly a vessel, of whatever rig, between a corvette and a gunboat, carrying from ten to eighteen guns.

Sloth, the name applied to two genera of edentate mammalia inhabiting South and Central America and forming the family Bradypodidæ. This family is distinguished by the flat, short head, and by the elongated legs, furnished with powerful claws of compressed and curved shape. No incisor teeth exist, but simple molars are developed. The stomach is of somewhat complex nature. The fore-limbs are longer than the hind-limbs, and have a powerful muscular organization. The palms and soles of the feet are turned inwards, and the claws are bent inwards towards the soles, so that the sloth's movements on the ground are both awkward and painful; but in their natural habitat amid the trees, the curved and inwardly disposed claws and limbs are seen to be admirably adapted for locomotion in their characteristic fashion, back downwards, through their native forests. Of the sloths the best-known species is the ai (*Bradypus tridactylus*), which has three toes and is of a brownish-grey colour, with darker tints on the face and limbs. The fur is of very coarse character. The unau, or two-toed sloth (*Cholœpus didactylus*), has an average length of about 2 feet, and its colour is a lighter grey than that of the ai. The tail in both species is either wanting, or at the most is of rudimentary character. Gigantic ground-sloths (Mylodon, Scelidotherium, and Glossotherium) formerly inhabited South America. They persisted into the human period.

Two-toed Sloth (*Cholœpus didactylus*)

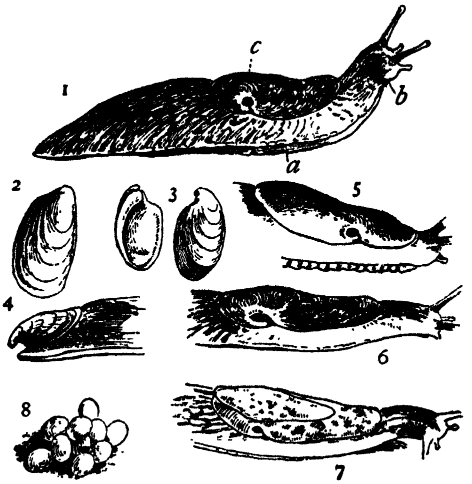
Slough, an urban district and market town of Buckinghamshire, England, a junction on the Great Western Railway. There are engineering-works, &c., and the town became notorious for the motor transport depot established there by H.M. Government during the European War. In 1920 it was sold to private buyers for about £7,000,000. Pop. (1921), 16,400.

Slovaks′, the name of a Slav people in Czecho-Slovakia, Moravia, and in adjacent states. They are the descendants of the Slavs that settled on the south of the Carpathians, between the Danube and the Theiss, where they maintained themselves for centuries, and in the ninth century formed the nucleus of the Great Moravian Empire. After the battle of Presburg, in 907, the Slovaks gradually fell under the yoke of the Magyars. Their religion is Roman Catholic or Lutheran. They possess a number of beautiful popular songs written in their dialect, which is a branch of the western group of Slavonic languages. The Slovaks number about 2,500,000.

Slovenes, a Slav people inhabiting the old Austro-Hungarian lands of Styria, Carinthia, Carniola, and Gorizia, united since the European War with the South Slavs to form the kingdom of the Serbs, Croats, and Slovenes, or Yugo-Slavia (q.v.). The Slovenes, often called Wends or Winds by the Germans, settled in these districts towards the end of the sixth century, having migrated there from Pannonia. Their land was incorporated under the name of the Windic March with the empire of Charlemagne. Out of this March were afterwards formed the Duchies of Styria, Carinthia, and Carniola, which fell to Germany and ultimately to Austria. Their dialects, belonging to the southern group of Slavonic languages, are closely allied to the Serbian. They number about 1,280,000, and are mostly Roman Catholics.

Slow-match, a match made so as to burn very slowly. The commonest kind of slow-match is a piece of slightly twisted hemp rope dipped in a solution of saltpetre, sugar of lead, &c. Slow-matches are chiefly used to fire mines or blasts, the object of using them being to allow the person who fires them to escape to a safe distance before the explosion takes place.

Slug, the name applied to several genera of gastropodous molluscs, included in the pulmonate (or ‘ lung-bearing ’) order of the class, and resembling the land-snails, but mostly without an external shell. The typical slugs form the family Limacidæ, and possess a rudimentary shell, internal in its nature, and generally concealed more or less completely by the mantle. The body is elongated, depressed, and attenuated backward, the head and tentacles retractile. The latter are four in number, the eyes being borne on the tips of the larger pair. Of the type-genus Limax there are several British species, including the great grey slug (*L. maximus*) and the field-slug (*L. agrestis*). The former, sometimes over 6 inches long, is the largest British slug. Both are fond of dark, moist places, and are mostly vegetable-feeders. Other genera are Arion, including the common black slug (*A. empiricorum*), which is sometimes found red and of other colours, and Testacella, represented by the little carnivorous *Testacella haliotidea*, which feeds chiefly upon earth-worms, and is generally found in the loose soil of gardens. Sea-slugs (Doris, Æolis, &c.) belong to another order.



1, Common grey field-slug (*Agriolimax agrestis*). *a*, foot; *b*, mouth; *c*, breathing pore. 2, Shell of *A. agrestis*. 3 Shells of *Testacella haliotidea*. 4, Tail end of Testacella showing shell. 5, Shield and respiratory pore of Arion. 6 and 7, Shield and respiratory pore of species of Limax. 8, Eggs of *Agriolimax agrestis*.

Small Holdings are distinguished from *allotments* by their greater size and by the circumstance that they constitute the main source of livelihood of those who cultivate them. Small holdings may not exceed 50 acres in area, unless the annual value is less than £50. The Act of 1892 empowered county councils to purchase land to sell or rent as small holdings. One-fifth of the purchase money was to be paid at the outset, and the rest by half-yearly instalments within fifty years. A fourth of the whole purchase money, however, might be secured by a perpetual rent charge. The Act was a failure. A considerable part of the Crown lands was offered for small holdings under an Act of 1906, and in 1908 a Small Holdings and Allotments Act came into operation, under which many such holdings have been allotted. It provided for similar holdings to those of the Act of 1892, gave county councils powers to acquire land compulsorily, and afforded tenants a right of compensation for improvements at their outgoing.

Smallpox, or Variola, is an acute disease, highly contagious, and characterized by an eruption which, beginning as macules, passes through various stages to pustules and finally forms scabs. It is of world-wide distribution, and is found alike in temperate climates and in the tropics, where it has generally a higher mortality. All ages are susceptible, and the rarity of the disease in children is due to recent vaccination. Epidemics in temperate countries, as a rule, occur towards the end of the autumn or in early spring. A patient is contagious throughout the whole disease, but the infectivity is highest from the vesicular to the scabbing stage of the eruption. The incubation period is generally about twelve days, and the onset is abrupt, with an attack of shivering, headache, and backache, with a rapid rise of temperature. The tongue is thickly furred, and there is complete loss of appetite, usually with constipation. In a short time the patient becomes seriously ill. Various prodromal rashes come out, but about the third day of the disease the typical eruption appears; at first as small red spots, rapidly becoming papules, which in about three days form vesicles. These later become pustules, till on the twelfth day of the disease the process of scabbing begins. The scabs are at first adherent, and later become detached, leaving a pigmented mark or scar. The depth of the scars left depends upon the degree of suppuration that has occurred, and, as a rule, this pitting is most marked on the face. All cases should be in special hospitals, on account of the risk of infection, and all persons engaged in nursing should be protected by recent vaccination, also all the original contacts of the patient should be vaccinated. Treatment is directed to the relief of symptoms, as no drug has any effect on the course of the disease. At first soothing lotions should be applied to the skin to relieve the irritation, and later tincture of iodine, painted on daily, is the most successful means of lessening the pitting. In those countries where vaccination has become established, the incidence of smallpox has been very much lowered, and in civilized countries outbreaks are now kept in check, though the two recent outbreaks in Great Britain, in Glasgow (1918–9) and in London (1922), have shown that many of the community were unvaccinated.

Smalt, a combination of common glass with the protoxide of cobalt, which imparts a deep-blue tinge to the glass. When reduced to an impalpable powder, it is employed in painting and printing upon earthenware, and to give a blue tint to writing-paper, linen, &c. It was discovered by a Bohemian glass-blower in the sixteenth century.

Smaltine, a mineral arsenide of cobalt, iron, and nickel, tin-white and hard, crystallizing in the cubic system. When nickel predominates over cobalt, the mineral is styled *chloanthite*.

Smarag'dite, a green foliated or fibrous variety of hornblende. It colours the ornamental gabbro styled *verde di Corsica*.

Smart, Christopher, British poet, born in 1722, died in 1771. He was educated at Pembroke College, Cambridge. Smart devoted himself to literary work, and, having settled in London, became intimate with Pope, Johnson, and Garrick. He died within the rules of the King's Bench prison for debtors. His chief work was *A Song to David* (1763), written on the walls of a lunatic asylum, where he was temporarily confined.

Smart, Sir George, musician, son of a music-seller in London, born in 1776, died in 1867. By industry and careful study he rose to be composer and organist to the Chapel-Royal, St. James's, and directed the music at the coronations of William IV and Queen Victoria. He was knighted in 1811. He conducted the principal musical festivals, and was the first to introduce Mendelssohn's oratorio *St. Paul* and Rossini's *Stabat Mater*. Among his pupils were Madame Sontag and Jenny Lind.

Smeaton, John, British engineer, born in 1724, died in 1792. Educated for the Bar, he abandoned the legal profession for engineering. In 1753 he was elected a Fellow of the Royal Society, and was awarded the Copley medal in 1759. In 1755 he was entrusted with the rebuilding of the Eddystone lighthouse, which was completed in Oct., 1759. It stood till 1882, when it was replaced by a new structure. Smeaton was subsequently employed on many works of great public utility, including the Forth and Clyde Canal.

Smedley, Francis Edward, novelist, born 1818, died 1864. He was a hopeless cripple from his infancy, and was unable to take active exercise of any kind. He was the author of *Frank Fairlegh* (1850), *Lewis Arundel* (1852), and *Harry Coverdale's Courtship* (1854).

Smell, the sense exercised in the perception of odours, through the functions of the olfactory nerves and their terminations. The sense is special in that the nerves devoted to the appreciation of odours exercise that function alone, and are not affected by any other kind of impressions; whilst again, no nerves are capable of receiving the particular impressions of odours but the olfactory filaments. The sense of smell is derived exclusively through those parts of the nasal cavities in which the olfactory nerves are distributed. (See *Nose*.) The matters of odour must in all cases be dissolved in the mucus of the mucous membrane before they can be immediately applied to or affect the olfactory nerve endings; thus for the perception of odours the mucous membrane of the nasal cavity must be moist. In animals living in the air it is also requisite that the odorous matter should be transmitted in a current through the nostrils. This is effected by an inspiratory movement, the mouth being closed. The *voluntary* nature of the act of smelling is also thus exemplified, since by interrupting the respiration or breathing, the sense cannot be duly exercised. The delicacy of the sense of smell is most remarkable; it can discern the presence of bodies so minute as to be undiscoverable even by spectrum analysis; $\frac{3}{100,000,000}$ of a grain of musk can be distinctly smelled. The olfactory nerves form the *first pair* of cranial nerves, or those given off directly from the brain as a centre. The facility with which different odours are perceived varies in different animals. Thus carnivorous mammalia are more susceptible to the odours of other animals than are herbivorous forms; and the latter in their turn are more readily affected by the smell of plants. Although the sense of smell in man is less acute than that of many animals, yet his sphere of susceptibility to various odours is more uniform and extended. The influence of *habit* is very marked in the exercise of this sense, custom enabling the individual to inhale odours which at first might be distasteful or nauseous to him.

Smelt, a small European fish, the *Osmērus eperlānus*, allied to the salmon, inhabiting the salt water about the mouths of rivers. It is of a silvery-white colour, the head and body being semi-transparent, and is from 4 to 8 inches long. It inhabits fresh water from August to May, and after spawning returns to the sea. When first taken out of the water, smelts have a strong smell of cucumber. It is called also the *sperling*, or *sparling*. The American smelt is the *Osmērus viridescens*, which inhabits the coasts of New England; but the name is given in America also to other fishes. The name of *sand smelt* is given to the *Atherīna presbyter*, a small fish allied to the mullets and climbing perches. It averages about 6 inches in length, and is of a pale-pink colour, with black spots on the head and back. This fish is most plentiful on the southern coasts of Britain, and is sought after chiefly for bait, but also as a food-fish.

Smethwick (smeth'ik), a manufacturing town (county and municipal borough) of Staffordshire, England, about 3 miles from Birmingham. It has extensive glass-works, chemical-works, engineering- and machine-works, foundries, rivet- and tube-works, safe-works, &c. Pop. 75,000.

Smew (*Mergellus albellus*), a swimming bird, found in winter on the coasts and in the ponds and lakes of Britain, and belonging to the merganser subdivision of the duck family. The smew is of shy habits. It flies well, but has an awkward gait on land. Its average length is from 15 to 18 inches. The head, chin, neck, and under parts of the male are white; the back is black, the wings black and white; the back of the head bears a crest of elongated feathers. The plumage of the female is reddish brown mixed with grey tints. The smew is also called the *white nun*. It is not known to breed in Britain.

Smila'ceæ, a tribe of plants belonging to the nat. ord. Liliaceæ, sometimes regarded as a separate order. They are mostly climbing plants, with woody stems and small unisexual flowers. They are found in small quantities in most parts of the world except in Africa. The genus Smilax embraces the various species of sarsaparilla. The tubers of *Smilax China* and of *Roxburghia vividiflora* are used for food.

Smiles, Samuel, British author, born in Scotland in 1812, died in 1904. Educated for the medical profession, he practised for some years at Leeds, and became editor of *The Leeds Times*. In 1845 he became secretary to the Leeds and Thirsk Railway, and in 1854 to the South-Eastern Railway, from which he retired in 1866. His works chiefly deal with industrial enterprise, and include: *Self-Help*, *Lives of the Engineers*, *Industrial Biography*, *Lives of Boulton and Watt*, *Character*, and *Thrift*.

Smith, Adam, British economist, born 1723, died 1790. His father was controller of the customs at Kirkcaldy. After leaving Kirkcaldy school he proceeded in 1737 to the University of Edinburgh, and to Balliol College, Oxford, in 1740. In 1751 he was appointed professor of logic at Glasgow, and in the next year professor of moral philosophy at the same university. His first publication, *The Theory of Moral Sentiments*, appeared in 1759, and was most favourably received. To this work he afterwards added an *Essay on the Origin of Languages*. In 1764 he attended the Duke of Buccleuch on his travels, and during a long stay in France became acquainted with Turgot, Necker, D'Alembert, and others. On his return to Scotland in 1766 he retired with his mother to Kirkcaldy, where, after ten years of close study, he wrote his celebrated *Inquiry into the Nature and Causes of the Wealth of Nations*. This work may be deemed the formal precursor of the modern science of economics. About two years later he obtained the lucrative post of commissioner of customs in Scotland. In 1787 he was chosen rector of Glasgow University. He was a man of much simplicity of character, and of a kind and benignant disposition. *The Wealth of Nations* has been translated into most European languages. —BIBLIOGRAPHY: Lord Haldane, *Life of Adam Smith*; F. W. Hirst, *Adam Smith*; Walter Bagehot, *Biographical Studies*; and article in Palgrave's *Dictionary of Political Economy*.

Smith, Albert, English writer, born 1816, died 1860. He was originally a physician, but turned his attention to literature, and produced a number of humorous works, such as *The Adventures of Mr. Ledbury, The Scattergood Family, Christopher Tadpole, The Pottleton Legacy*, &c. But his greatest success was achieved in his entertainments, his panorama of Mont Blanc being an especial favourite.

Smith, Alexander, Scottish poet and essayist, born 1830, died 1867. In 1852 he published his *Life Drama.* In 1854 he was appointed secretary to the University of Edinburgh, and the following year produced, in conjunction with Sydney Dobell, a volume of *Sonnets on the War.* This was followed in 1857 by his *City Poems*, to which succeeded his longest and best poetical work, *Edwin of Deira* (1861). In 1863 he published a collection of papers entitled *Dreamthorp*, which was succeeded by *A Summer in Skye* and *Alfred Hagart's Household.*

Smith, Frederick Edwin, first Earl of Birkenhead, British lawyer and politician, was born in 1872 at Birkenhead. He was educated locally, and at Wadham College, Oxford, where he took a first class in jurisprudence, and was Vinerian law scholar and president of the Union. He was called to the Bar in 1899, became K.C. in 1908, Solicitor-General in 1915, and Attorney-General in 1915, and was Lord Chancellor from 1919 to 1922. He entered Parliament in 1906 as Conservative member for the Walton division of Liverpool. In 1912 he was the right-hand man of Sir Edward (now Lord) Carson (q.v.) in organizing opposition in Ulster to the Home Rule Bill. This did not prevent him from playing a prominent part in the negotiations with the Sinn Fein leaders which led to the signing of the 'Peace Treaty' in Dec., 1921.

Smith, George, British Assyriologist, born 1840, died 1876. In 1872 he made known his striking discovery of a series of tablets in the British Museum containing, amongst other records, the Babylonian legend of the flood. This led to his making two expeditions to the site of Nineveh, resulting in the finding of inscriptions completing portions previously discovered. Particulars of these journeys are recorded in his *Assyrian Discoveries*, published in 1875, and other results were contained in his *Chaldean Account of Genesis* (1876). In 1876 he made another journey to the East for the purpose of continuing his explorations, but died at Aleppo. He wrote, among other works, concise histories of Assyria and Babylon.

Smith, Goldwin, British historical writer, born 1823, died 1910. He was educated at Eton and Oxford, where he held the post of regius professor of history from 1858 to 1866. As a lecturer he attracted great attention both on account of his strongly democratic views and his striking originality. Having during the American Civil War strongly defended the cause of the North, he was at the close of the war invited to visit the United States to deliver a course of lectures, and his visit resulted in his accepting the professorship of history at Cornell University, New York. He resigned the appointment in 1871, and was appointed member of the senate of the University of Toronto, where he resided for the rest of his life. Among his chief works are: *Lectures on Modern History*; *The Empire*, a series of letters; *Speeches and Letters on the Rebellion*; *The United States*; and *The United Kingdom.*

Smith, Henry John Stephen, British mathematician, was born at Dublin in 1826, and died at Oxford in 1883. As a student at Oxford University he had a brilliant career, taking a double first, and winning the Ireland Scholarship. He became a mathematical lecturer at Balliol College in 1850, and in 1860 was elected to the Savilian chair of geometry. He became F.R.S. in 1861, was president of the mathematical section of the British Association in 1873, and was president of the London Mathematical Society from 1874 to 1876. In 1877 he was appointed the first chairman of the Meteorological Council. Henry Smith was regarded by those who knew him as a man of unique ability. Jowett, Conington, Lord Bowen, and Huxley all spoke of him in terms which implied that they considered him the ablest man they knew. As a mathematician he wrote a good deal on geometry and on elliptic functions, but he is chiefly distinguished for his researches in the theory of numbers. His reports to the British Association on this subject, published in the years from 1859 to 1865, are masterpieces of their kind. By a strange oversight, one of the problems which he solved was chosen many years afterwards, in 1882, by the French Academy of Sciences as the subject for the grand prize in mathematics. Smith's collected mathematical papers have been published in two volumes, under the editorship of Dr. Glaisher.

Smith, Horace and James, the joint-authors of the celebrated *Rejected Addresses*, were born, James in 1775, and Horace in 1779. In 1812 the competition started by the management for the best poetical address to be read at the opening of Drury Lane Theatre, when rebuilt after the fire, suggested to the Smiths the idea of producing a collection of parodies of the most noted writers of the day, under the designation of *Rejected Addresses.* It contains some of the best parodies in English. The work was hailed with enthusiastic applause, and rapidly ran through numerous editions. Horace also wrote several novels. James died in 1839, Horace in 1849.

Smith, Sir James Edward, British botanist, born 1759, died 1828. He was a physician by profession. The Linnæan Society, of which he continued president till his death, was founded by him in conjunction with others in 1788. He was knighted in 1814. His principal works are: *English Botany, Flora Britannica*, and *The English Flora.*

Smith, John (commonly known as Captain John Smith), one of the founders of the English colony in Virginia, born in 1580, died in 1631. After many adventures as a soldier of fortune in Europe, Asia, and Africa, he joined in the project to colonize Virginia. The first expedition, which left London in 1606, consisted of three ships and about 180 colonists and sailors. Dissensions broke out before they had reached their destination, and Smith was condemned to be hanged; but he escaped this fate, and became an active member of the colony. He made important geographical discoveries, obtained supplies from the natives, and was finally entrusted with the guidance of the colony. For a time he was a prisoner among the Indians, but was released at the intercession of Princess Pocahontas (q.v.). In 1609 he was obliged to return to England. He subsequently visited the New England coast for the purpose of trade, and was taken prisoner by a French ship. He published: *A True Relation of the Events connected with the Colonization of Virginia*; *Map of Virginia, with a Description of the Country*; *A Description of New England*; and *General History of Virginia.*—Cf. A. G. Bradley, *Captain John Smith.*

Smith, Joseph, founder of Mormonism, was born in Vermont in 1805, and was killed at Carthage, Illinois, in 1844. See *Mormonism.*

Smith, Sydney, British divine, born in 1771, died in 1845. He was educated at Winchester College, and at New College, Oxford, where he took his degree of M.A. in 1796, becoming Fellow a few years afterwards. In 1797 he obtained the curacy of Netheravon, a village on Salisbury Plain, where he passed about two years. He then went to Edinburgh, continued there for five years, and was one of the founders, in 1802, of *The Edinburgh Review,* being also one of its most influential contributors. In 1804 he removed to London, and in 1806 he was presented to the living of Foston-le-Clay, in Yorkshire. In 1807 appeared anonymously his celebrated *Letters of Peter Plymley,* intended to further the cause of Catholic emancipation. His liberal views on politics excluded him for a long time from Church preferment; but in 1828 he was presented to the rectory of Combe Florey, in Somersetshire, and in 1831, during the ministry of Earl Grey, he became one of the canons of St. Paul's, London, where he henceforth resided. A few years before his death a collected edition of his writings was published under his own supervision, including papers contributed to *The Edinburgh Review, Sketches of Moral Philosophy,* &c.—Cf. G. W. E. Russell, *Sydney Smith* (in English Men of Letters Series).

Smith, William, the 'father of English geology', born in 1769, died in 1839. Acting successively as land surveyor, mining surveyor, and canal engineer, he was led to study geology. He became convinced that each stratum contained its own peculiar fossils, and might be discriminated by them, and in 1815 he was able to submit a complete coloured map of the strata of England and Wales to the Society of Arts. His fame as an original discoverer was now secure; but becoming involved in pecuniary difficulties, he was obliged to part with his geological collection to the British Museum. Subsequently a pension was granted to him by the Government.

Smith, Sir William, British classical scholar, born 1813, died 1893. He edited the well-known series of Classical, Biblical, and Ecclesiastical Dictionaries, and wrote or edited many educational books. From 1867 he was editor of *The Quarterly Review.*

Smith, William Henry, British politician, son of W. H. Smith, bookseller, publisher, and newsagent, Strand, London, was born in 1825, died in 1891. Educated at Tavistock, he became in due course a member of his father's firm. In 1868 he contested Westminster in the Conservative interest for the second time, and was successful. He continued to sit for Westminster till 1885, when, after the Redistribution Bill, he was returned for the Strand, for which division he was member till his death. Smith was a member of the London School Board from 1870 to 1874, and subsequently held the following appointments: Financial Secretary to the Treasury (1874–7), First Lord of the Admiralty (1877–80), and Secretary for War (1885). In 1886, on the resignation of Lord Randolph Churchill, he vacated the War Office, and assumed the leadership of the House of Commons as First Lord of the Treasury.

Smith, William Robertson, British Biblical scholar, born at Keig, Aberdeenshire, 1846, died 1894. He was educated at the University of Aberdeen, subsequently spending some time at the New College, Edinburgh, and at the Universities of Bonn and Göttingen. From 1868 to 1870 he held the post of assistant professor of physics at Edinburgh. Appointed in 1870 professor of Hebrew in the Free Church College, Aberdeen, he was removed from the post by the General Assembly in 1881 on account of his critical views on the Old Testament. From 1881 Professor

Smith was connected with the editorship of the *Encyclopædia Britannica*, and after the death of Professor Baynes was editor-in-chief. He was a member of the Old Testament Revision Committee, in 1879–80 travelled in Arabia, in 1883 became Lord Almoner's professor of Arabic at Cambridge, in 1886 librarian of the university, and in 1889 professor of Arabic. He is the author, among other works, of *The Old Testament in the Jewish Church*, *The Prophets of Israel and their Place in History to the Close of the 8th Century B.C.*, *Kinship and Marriage in Early Arabia*, and *Religion of the Semites*.

Smith, Sir William Sidney, British sailor, born in 1764, died in 1840. He entered the navy at the age of twelve, received his lieutenancy at sixteen, and when nineteen was created post-captain. Cruising with a small flotilla against the French, he was made prisoner in an attempt to cut out a vessel at Havre, and was detained for two years, when he escaped and was posted to the *Tiger*. He served in Syria, and in Egypt against Bonaparte, and was wounded at the battle of Alexandria. In 1802 he entered Parliament as member for Rochester. He was created rear-admiral of the blue in 1805, and in 1806 was in action against the French off the coast of Naples. In 1807 he accompanied Admiral Duckworth to the Dardanelles, where he distinguished himself by the destruction of a Turkish squadron.

Smith-Dorrien, Sir Horace Lockwood, British soldier, born in 1858. After passing through Harrow and Sandhurst he joined the Sherwood Foresters (Notts and Derby) in 1876, and served through the Zulu War (1879), Sudan and Egypt (1882–6), and Chitral and Tirah (1897–8) campaigns. In 1899 he went to South Africa, and became major-general. Subsequent to the appointments of adjutant-general in India (1901–3) and the command of the Quetta Division (1903–7) he was knighted (1904), and held successively the Aldershot (1907–12) and Southern (1912–4) commands, becoming general in 1912. On the outbreak of the European War he succeeded Sir James Grierson in command of the 2nd Corps, fought the battle of Le Cateau, and was eventually posted to East Africa in command, but was compelled to return owing to ill-health. He became Governor of Gibraltar in 1918.

Smithfield, a district of London. In ancient times it was outside the old city walls, and before the days of Tyburn was the place of public executions. In the time of religious intolerance it obtained an evil repute for its burnings in the name of religion. Bartholomew Fair, so often mentioned in our literature, was held at Smithfield. A cattle market was held here as far back as 1150. On the site of the old market there is a central meat market, a poultry and provision market, and a vegetable and fish market.

Smithsonian Institution, educational institution in Washington, organized by Act of Congress in 1846 to carry into effect the provisions of the will of James Smithson, the founder, a natural son of the Duke of Northumberland (1765–1829). Smithson left his property (worth £120,000) to his nephew, with the condition that if the latter died without issue the property was to go to the United States to found an establishment for the increase and diffusion of knowledge. In 1835 the nephew died childless, and in 1838 the sum of 515,169 dollars was paid to the Treasury of the United States. In 1846 the interest on this sum (the principal itself was to remain untouched) was applied to the erection of a suitable building, with apartments for the reception and arrangement of objects of natural history, including a geological and mineralogical cabinet, a chemical laboratory, a library, a gallery of art, and the necessary lecture-rooms. The funds have since been increased and the scope of the institution enlarged. It gives much support to scientific research and the publication of works too costly for private enterprise. Several series of publications are issued, including *Contributions to Knowledge*, *Miscellaneous Collections*, and *Annual Reports*. The building contains the National Museum, which is, however, wholly maintained by the Government. The institution is administered by regents, composed of the Chief Justice of the United States, three members of the Senate, and three of the House of Representatives, with six other persons, not members of Congress. The President, Vice-President, and members of the Cabinet for the time being have the position of governors or visitors of the institution, the President being *ex officio* at the head. —Cf. G. B. Goode, *The Smithsonian Institution*.

Smithsonite, a common white ore of zinc, consisting of the carbonate, and often styled calamine by English writers. It usually occurs massive, and is often an alteration-product of limestone.

Smith's Prizes, in the University of Cambridge, are awarded annually for the best essays on any subject of mathematics or natural philosophy. Candidates must be bachelors of arts, and twelve to fourteen terms must have elapsed since they commenced residence. The two prizes are of the value of about £23 each, and were founded by Robert Smith (1689–1768), who was Plumian professor of astronomy and afterwards master of Trinity College. Among winners of the prizes who afterwards became eminent mathematicians or physicists may be mentioned: Stokes, Cayley, Adams, Lord Kelvin, Tait, Clerk Maxwell, Lord Rayleigh, Hill, Larmor, and Forsyth.

Smoke-plant, a beautiful deciduous South European shrub, *Rhus cotinus*, nat. ord. Anacardiaceæ, yielding the yellow dyewood called young fustic, and used also in tanning.

Smoke Prevention. One of the greatest problems confronting our town authorities is the preservation of a comparatively clean atmosphere. If all fuel were burned under conditions in which the full heat value could be developed, the atmosphere in densely populated districts and industrial areas would be kept quite clean. Those who speak and write on this subject may be divided into two groups, the one crediting the major part of the trouble to domestic-fuel users, and the other blaming the owners of large works. It must always be remembered that many who make themselves heard on this subject may have an axe to grind. They have often an interest in advocating the use of gas fires and electric heaters. To those who have much to do with test-work in connection with combustion, there seems little doubt that if reasonable care were taken in the stoking operations of industrial steam plant, much of the trouble could be done away with. When works managers do not take the trouble to save our national fuel resources by ensuring that complete combustion is maintained in their boiler furnaces, they should be compelled to do so to preserve the health of the people who live in the neighbourhood of their factories, but the framing of suitable legislation is very difficult.

Fog consists of minute bituminous balloons filled with unburnt hydrocarbons from the fuel. These rise in the atmosphere, but are brought down again with water vapour when there is a low atmospheric temperature.

The production of gas from coal by carbonization and its use in boiler furnaces, combined with the use of the residual solid fuel in domestic fires, may make the preservation of a clean atmosphere a more simple task. See *Low-temperature Carbonization.*

Smolensk′, a government of Central Russia; area, 21,624 sq. miles; pop. 2,200,000.

Smolensk, a city of Russia, capital of the government of Smolensk, on the Dnieper. Manufactures include linen, leather, hats, carpets, and soap; and trade is chiefly in corn and hemp. Smolensk was a place of importance as early as the ninth century, and was partly burned by the French in 1812. Pop. 76,000.

Smol′lett, Tobias George, British novelist, was born near Bonhill, Dumbartonshire, in 1721, and died near Leghorn on 17th Sept., 1771. He came of a family which had long been influential in Dumbartonshire; his grandfather, Sir James, was laird of Bonhill, and had been knighted by William III in 1698. His father, a younger son who had married imprudently, died when the future novelist was two years of age. Smollett was educated at Dumbarton School, and proceeded thence to Glasgow University in 1736, being at the same time apprenticed to Dr. John Gordon, a well-known surgeon. At the age of eighteen he wrote a tragedy entitled *The Regicide,* which was based upon Buchanan's account of the death of James I of Scotland. The ill-success of this tragedy, though fully deserved, did much towards permanently embittering Smollett. In 1739 he proceeded to London, and failed to interest Lyttelton, Fielding's patron, in his work. He avenged himself eight years later in characteristic fashion by writing his heartless *Burlesque Ode on the Death of a Grandmother* to parody Lyttelton's *Monody* to the memory of his wife. In despair of attaining literary success, Smollett secured the post of surgeon's mate on board H.M.S. *Cumberland,* and took part in the ill-fated siege of Cartagena in 1741. When the fleet raised the siege and went to Jamaica, Smollett accompanied it, and there fell in love with the daughter of a planter, Nancy Lascelles, whom he married in 1747. He removed his name from the navy books in 1744, and set up as a surgeon in Downing Street, but failed to secure a large practice.

In 1746 Smollett wrote the most famous of his poems, *The Tears of Scotland,* a lament for Culloden. His earliest publication, *Advice, a Satire,* which has some of Juvenal's repellent qualities without any of Juvenal's power, appeared in the same year. Its sequel, *Reproof, a Satire,* appeared in 1747. In the next year, 1748, Smollett published his first great novel, *The Adventures of Roderick Random.* Fielding had published *Joseph Andrews* in 1742, and Lady Mary Wortley Montagu attributed *Roderick Random* to him. A French version which appeared in 1761 was described as " de l'anglais de M. Fielding ". Like many first novels, *Roderick Random* is the freshest of its author's works. It is largely, though not wholly, autobiographical. It is especially excellent in its delineation of the British tar. The book owes something to Swift, Defoe, and Fielding, but very much more to Le Sage. The success of this work encouraged Smollett to publish his unfortunate tragedy in 1748, and to write another picaresque novel, *The Adventures of Peregrine Pickle,* published 1751. Before writing *Peregrine Pickle* Smollett went to France with his future biographer, Dr. Moore (author of *Zeluco* and father of Sir John Moore of Coruña), in order to collect material. Amongst other specimens of oddity he collected Mark Akenside, to whom he has given an undesirable kind of immortality—an immortality which *The Pleasures of Imagination* has failed to confer. *Peregrine Pickle* is even more loosely constructed than its predecessor; it is full of cynical asperities and personalities (some of which were removed in the second edition), and it contains many interpolations, of which the most infamous is chap. lxxxi, *Memoirs of a Lady of Quality.* These *Memoirs* were a *chronique scandaleuse,* written by Fanny, Viscountess Vane (1718–88), who paid Smollett handsomely to publish this account of her own shame, which is not even interesting. Had she lived a hundred and seventy years later, she would probably, instead of paying for publication, have been paid many thousands of pounds for the copyright of her *Memoirs.* In spite of its disadvantages, *Peregrine Pickle* is a great novel, and in the death scene of Commodore Trunnion, Smollett displays his talent at its very best.

Smollett did not yet despair of earning a living by medicine. He took the degree of M.D. at Marischal College, Aberdeen, in June, 1750, and attempted to set up a practice in Bath. In 1752 he published *An Essay on the External use of Water,* in which he endeavoured to prove (an action not unlike that of Dr. Stockmann in *An Enemy of the People*) that the mineral water of Bath had little advantage over ordinary water. After this he abandoned all hope of earning a livelihood by any means other than literature. His third novel, *The Adventures of Ferdinand Count Fathom,* appeared in 1753. It is a sordid and squalid book, revolting as a whole, but extremely powerful in parts. Its description of the robbers' hut in the forest has been often imitated but never excelled. *Ferdinand Count Fathom* owed its conception to Fielding's *Jonathan Wild,* but it is greatly inferior to its prototype.

Smollett now commenced the arduous career of a universal provider of literature. He translated *Don Quixote* (1755), and was accused of having made an unfair use of Jervas's version. He edited *The Critical Review; The British Magazine* (1760); and *The Briton,* a weekly paper, price 2½*d.*, which ran from May, 1762, to Feb., 1763, when it was put out of action by Wilkes's *The North Briton.* To *The British Magazine* he contributed a serial, *The Adventures of Sir Launcelot Greaves,* the least interesting of all his writings. It maladroitly transplants Don Quixote into eighteenth-century England. In 1758 Smollett published his *Complete History of England, from the descent of Julius Cæsar to the Treaty of Aix-la-Chapelle, 1748,* which he wrote at the rate of about a century a month. A continuation followed in five volumes (1762–5). His *History* is readable, and no more inaccurate than was to be expected of work produced under such conditions. It remained for many years a standard book. He also compiled *A Compendium of Authentic and Entertaining Voyages* (1756) and *The Present State of all Nations* (1768), edited a translation of the works of Voltaire in twenty-five volumes (1761), and had some share in a translation of *Gil Blas.* In 1757 Garrick produced, at Drury Lane, Smollett's comedy *The Reprisal: or the Tars of Old England,* a piece of most ungracious fooling directed against the French navy. All these works were undertaken frankly to make money, and none contains any of Smollett's characteristic touches, though all show signs of his literary ability and fluency.

In 1763 Elizabeth, Smollett's only child, died at the age of fifteen. Smollett was never the same man again. He went abroad with his wife for two years, staying most of the time at Nice, and in 1766 published his *Travels through France and Italy,* a book which displays Smollett's acerbity no less than his ability. He visited Scotland in 1766; in 1768 he published his political satire, *The History and Adventures of an Atom,* a powerful but coarse Rabelaisian work. In 1769 Smollett's health broke down completely, and he left England finally, and settled near Leghorn, where he died. During the last year of his life he wrote the greatest of his novels, *The Expedition of Humphry Clinker* (1771). This is as easily Smollett's masterpiece as *Tom Jones* is Fielding's, and is in many ways the second greatest of eighteenth-century novels. The rough places of Smollett's nature have been made smooth, and his genius is at its best. Bramble, Mrs. Tabitha, and Lismahago are the best portraits in all his gallery. *Humphry Clinker* is a remarkable example of fresh and vigorous work produced at the close of an unhappy life.

It is impossible to avoid comparing Smollett with Fielding, to the disadvantage of the former. Fielding was an observer of the characters of human life, Smollett a describer of its various eccentricities. Fielding excelled, especially in his masterpiece, at constructing plots; Smollett's novels owe what little unity they have to the fact that they deal with the adventures of one man, and, as Aristotle says (*Poetics*, viii), " Unity of plot does not, as some persons think, consist in the unity of the hero ". Above all, Fielding was a man of wise tolerance and sanity, while Smollett was imprudent, querulous, and prone to anger. But when all is said and done, Smollett is supremely great. His most noticeable feature is the prodigality of his wit; he sows humorous incidents with the whole sack. He is easier to imitate than his great contemporary, and has had many distinguished pupils, of whom the greatest is Dickens. His works have been ransacked for comic material from the time they first appeared until the present day. Some of his humour is somewhat elementary, and appeals most to those who

> " find huge wealth in one pound one,
> Vast wit in broken noses ",

but much of it is mellow and profound, and has increased the gaiety of nations, as it is appreciated on the Continent as much as in Great Britain. Both in style and vocabulary Smollett is more modern than Fielding; and in two respects he seems to have been a pioneer of modern literary methods. He travelled to collect material, and he published a tale in a serial form. —BIBLIOGRAPHY: R. Chambers, *Smollett: his Life and a Selection from his Writings*; D. Hannay, *Life of Tobias George Smollett*; O. Smeaton, *Tobias Smollett*; Sir Walter Raleigh, *The English Novel*; W. M. Thackeray, *The English Humourists of the Eighteenth Century*; W. Hazlitt, *Lectures on the English Comic Writers.*

Smuggling. Legislation against smuggling dates back to the fourteenth century, the penalties being made more stringent as the customs duties were increased and smuggling thereby made more profitable. The principal statutes now are The Customs Laws Consolidation Act, 1876, and The Customs and Inland Revenue Acts, 1879 and 1881. Vessels engaged in smuggling goods are to be forfeited and the owners and masters subjected to a fine not exceeding £500 each. Any person guilty of fraudulent evasion of customs duties is liable to a penalty of £100 or treble the value of the goods and duty. Customs officers have the right to search suspected smugglers. It is an offence to destroy any goods to prevent their seizure, to rescue or attempt to rescue goods which have been seized or persons who have been apprehended, to obstruct an officer in his duty, to assemble to the number of three persons to run goods, &c. A person upon whose premises smuggled goods have been found is not liable to a penalty unless he knew that the goods were there and were contraband.

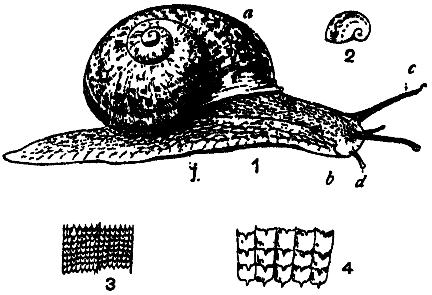
Smut, a destructive disease of corn, in which the grain is converted into a black, soot-like powder. It is caused by parasitic fungi of the genus Ustilago, there being species peculiar to each kind of cereal. Grain from a badly infected field should not be used for seed, nor should smutted grain be thrown on to a manure-heap, as the fungus multiplies very rapidly in organic solutions. Soaking the seed-grain in weak copper sulphate solution, or scalding it with hot water (about 130° F.), also helps to keep down the disease. See *Ustilagineæ.*

Smuts, Jan Christian, South African statesman and soldier, born 1870. He was educated at Stellenbosch and Cambridge, entered the law (1895), was appointed State Attorney of the Transvaal by Kruger (1898), and took part in the South African War (1899–1902), rising to the rank of general, and becoming a recognized Boer leader. He was the right-hand man of General Botha during the latter's administration of the Transvaal and of the Union of South Africa, and became famous as an administrator. On the outbreak of the European War he organized the forces of the Union, crushed the rebellion of 1914, and succeeded Smith-Dorrien in command of the German East Africa theatre (Feb., 1916). By the end of the year he had completely broken the German resistance and smashed their military organization. He was summoned to the Imperial War Cabinet, and, with Botha, he represented South Africa at the Paris Peace Conference. Botha's death opened to him the premiership of the Union, and he assumed office in Sept., 1919, and subsequently formed the South African party, who supported Union membership of the British Commonwealth, as opposed to Herzog's ideal of an independent republic.

Smyrna, a seaport, and the chief commercial town of Asia Minor, on the Gulf of Smyrna; the terminus of the Smyrna-Aidin and Smyrna-Kassaba railways. In its geographic situation Smyrna possesses a valuable asset, and to this was, and will be due, the peculiarly cosmopolitan organization of business life within the city. Before the European War 140,000 Greek Christians, all subjects of Turkey, comprised about half the population, and trade was mainly in their hands. Smyrna produces practically nothing; her prosperity is founded upon trade; but the progress of this trade has largely been due to the labours of the Turks of the interior, who furnish all the produce, and not to the Greeks, who buy and sell it. The chief exports are dried fruits (figs, raisins, and currants), grain, valonia, olive-oil, tobacco, opium, wool, liquorice-root, skins, raw cotton, and emery. In addition to its work as a port for the hinterland, Smyrna is also the bazaar of the adjacent islands, and the port is well-served by foreign steamships. Most European business houses are British. Pop. 400,000.

Smyrna is an ancient city whose ultimate origin is lost in antiquity, but it had been abandoned for about 400 years anterior to its restoration by Alexander the Great. It is the reputed birth-place of Homer (q.v.). Christianity was early introduced, and the city was one of the Seven Churches referred to by St. John in *Revelation* (ii, 8–11). As a coastal city it was exposed to all the vicissitudes of the Byzantine Empire in its wars with Saracens, Crusaders, Genoese, and Turks; and it successively fell to Seljuks and Timour (1402), and eventually (1419) to the Osmanlis, in whose possession it remained until 15th May, 1919, when the Greeks occupied the city and the adjacent countryside. The victorious arms of Mustafa Kemal's Nationalist armies, however, combined with disorganization and corruption in the Greek forces, permitted of the reoccupation of the city by the Turks (1922), during which many of the principal buildings were given to the flames. See *Turkey* (*History*).

Snail, a slimy, slow-creeping, air-breathing gastropod mollusc belonging to the genus Helix of Linnæus, now raised into the family Helicidæ, and differing from the slugs (Limacidæ) chiefly in having a spiral shell. The head is furnished with four retractile horns or tentacles; and on the superior pair, at the extremity, the eyes are placed. The sexes are united in the same individual, but the union of two such hermaphrodite individuals is necessary for fertilization. The common garden snail (*Helix aspersa*) is the most familiar species of the typical genus. The mischief done by it to garden produce on which it feeds is very extensive. Nearly equally well known is the Roman or edible snail (*H. pomatia*), largely found in France ('escargot'), and cultivated there and elsewhere for food purposes.



1, Large Garden Snail (*Helix aspersa*): *a*, Shell; *b*, Mouth; *c* and *d*, Tentacles; *f*, Foot. 2, Young Snail. 3, Part of Radula, enlarged. 4, Teeth further enlarged.

Snake. See *Serpents.*

Snake-eel, a popular name of fishes belonging to the genus Ophichthys, included with true eels in the family Murænidæ. The tail tapers to a point like that of a snake. They are natives of warm seas.

Snake-stone, a popular name of the fossils called Ammonites. The name is also given to certain small rounded pieces of stone, or other hard substance, popularly believed to be efficacious in curing snake-bites.

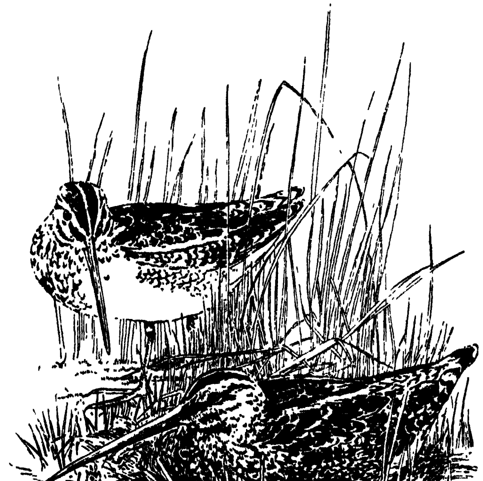
Snake-wood, the wood of the *Strychnos colubrīna*, nat. ord. Loganiaceæ, a tree growing in India, Java, and other parts of the East, having a bitter taste, and supposed to be a certain remedy for the bite of the hooded serpent. Also the Demerara letter-wood (*Brosimum Aubletii*), a tree of the nat. ord. Moraceæ. It has this name from the heart-wood being mottled with irregularly shaped dark spots. The timber is excessively hard.

Snapping-turtle, a species of freshwater tortoise belonging to the genus Chelydra (*C. serpentīna*), common to all parts of the United States. It feeds on small animals, is bold and fierce, and is so named from its propensity to snap at everything within its reach. Another tortoise (*Macroclemmys temmincki*) of similar habits, but larger (sometimes weighing 100 lb.), receives the same name, and is also known as the alligator turtle.

Sneeze-wood, a South African tree (*Ptæroxylon utile*), nat. ord. Sapindaceæ, yielding a solid, strong, durable timber rivalling mahogany in beauty. Its dust causes sneezing, so that it is troublesome to work.

Sneezing is a reflex action of the respiratory organs, usually brought on by some irritation to the nasal mucous membrane. There is first a deep inspiration followed by an expiration, which, instead of being easy and uninterrupted as in normal breathing, is obstructed, and the blast of air on escaping from the lungs is directed, by an instinctive contraction of the pillars of the fauces and lowering of the soft palate, chiefly through the nose in an attempt to expel the cause of the irritation.

Snipe, the English name for those plover-like birds which form the genus Gallinago. The common snipe (*G. cœlestis*) is a beautifully marked bird, about 10 or 11 inches long. It is plentiful in most parts of Britain, and frequents marshy or moist grounds. It feeds on worms, insects, and small molluscs. It is re-



Snipe

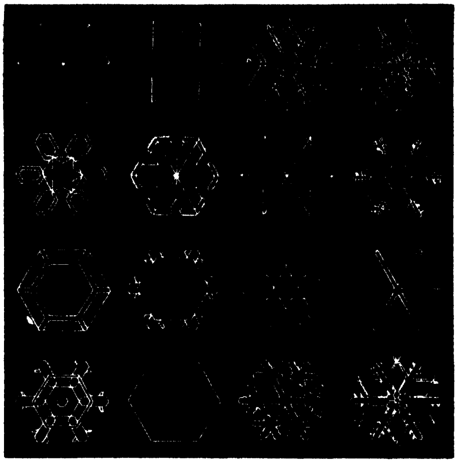
markable for the length of its bill, its peculiar bleating cry, and the drumming-like noise it makes in summer. The jack snipe (*G. gallinŭla*) closely resembles the common snipe in its general habits and appearance, but is seldom seen in Britain except in the winter. In North America there are several species of snipe, Wilson's snipe (*G. wilsoni* or *delicata*) being one of the chief. Other species are native to Africa, Asia, and South America. The name of sea snipe is sometimes given to the dunlin, whilst the name summer snipe is applied to the common sandpiper.

Snipe-fish. See *Bellows-fish.*

Snipers and Sniping. In its modern sense the word ' sniping ' is used to distinguish the individual rifle-fire of a highly trained specialist working by himself from the independent fire of small bodies of men (fire-units; see *Musketry*) directed and controlled by fire-unit commanders. Snipers are essential in modern warfare, and during the trench-war phase of the European War the Germans brought sniping to a fine art, and inflicted many casualties on opposing troops. In modern warfare superiority of fire is all-important, and in obtaining this the sniper plays a great part, for, if well posted and concealed, he can prevent the enemy from showing a head over the parapet to fire or observe, and any visible movement becomes impossible. Moreover, one sniper can knock out loopholes and prevent them being rebuilt, can destroy periscopes, and can harass the enemy in a variety of ways. The sniper must necessarily be a first-class marksman; he is usually provided with a telescopic sight for his rifle, and should always have field-glasses. Besides the ordinary telescopic sight, a periscope arrangement is also used, enabling the sniper skilled in its use to fire in comparative safety from behind a parapet. These contrivances are very accurate. The work of a sniper is very trying to the nerves, and men selected for duty as such must be trained in many details, among which are: (1) observation and direction of aim; (2) use of the periscope, the telescope, and of field-glasses; (3) accurate judging of distance; (4) selection of suitable points from which to fire and observe; and (5) building and concealment of snipers' posts.

Snorri Sturluson, an Icelandic poet and historian, born in 1178, died in 1241. Tracing his descent from the kings of Norway, he early turned his attention to the history of their doings, and made a collection of sagas entitled *The Heimskringla* (The Ring of the World), in which are interspersed songs of his own composing. It contains a record of the Norwegian kings from the earliest time to the death of Magnus Erlingsson (1177), and was first printed in 1697. It has been translated into several languages. Snorri became chief judge of Iceland, but his ambitious and intriguing character led to his assassination. Snorri's name is also connected with the prose Edda (q.v.).

Snow is formed by the aqueous vapour of the atmosphere being condensed at a temperature below 32° F., and thereby passing directly into the solid form. Snow-flakes are of crystalline structure, and are very variable in size. If the temperature is as low as 10° below zero F., the snow may fall in single crystals. At higher temperatures the crystals combine to form flakes, which are in general larger if there is wind and also the more nearly the temperature approaches to 32° F. Snow-crystals present patterns of exquisite beauty. They are always of a hexagonal build, being modifications of a six-rayed star, the rays forming angles of 60°. The two main classes are the *columnar*, where the central feature is an elongated or column-like structure, and *tabular*, or flat-shaped. Sub-classes have been distinguished as lamellar, spicular, pyramidal, and fern-stellar. The number of modifications and combinations is practically endless. Generally there is uniformity among the flakes falling in the same shower. The hypothetical line above which the earth remains snow-covered all the year is called the snow-line. At the Arctic Circle it is at about sea-level. On the equator perpetual snow is found only at about 16,000 feet, as on the summits of the Andes, and on Kilimanjaro in Tanganyika. In Great Britain it is scarcely reached by the highest mountain, Ben Nevis. The height depends largely upon the amount of snowfall. Thus on the northern side of the Himâlaya it is about 18,000 feet, but on the southern about 2000 feet lower, due to the heavy deposition by



Snow-crystals

the south-western monsoon. Snow scarcely ever falls at the sea-level below lat. 30°, and rarely below 40°. Beyond 40° it is common on the higher grounds, and still farther it is general at all levels in winter. A heavy fall occurred in Canton in 1836, where it is practically unknown. In Feb., 1920, there was a snowfall to the depth of 39 inches in Jerusalem. This was the heaviest since 1830.

The water equivalent of freshly fallen snow is about one-tenth or one-twelfth of its bulk, so that it is said that 1 foot depth of snow is equivalent to 1 inch of rain. Besides disappearing through melting and evaporation, snow is removed from the higher grounds by descent in the solid form under the action of gravity, in some cases rapidly and with destructive effects in the avalanche, in others through the gradual conversion of the piled-up snows into ice, which descends in the form of glaciers, or rivers of ice. Owing to the large amount of air contained in a mass of fallen snow, it is a very bad conductor of heat, and therefore forms a protective covering to vegetation against extremely severe frosts. Soil and plants under a few inches of snow have been found soft and uninjured, when bare ground adjacent was frozen to a depth of 18 inches.

Snowball Tree, the garden variety of the *Viburnum Opŭlus* (nat. ord. Caprifoliaceæ) or guelder rose (q.v.).

Snowberry, the popular name of tropical American shrubs of the genus Chiococca, nat. ord. Rubiaceæ, sub-order Cinchoneæ. The fruit consists of snow-white berries. Also, and in England more usually, applied to *Symphoricarpus racemōsus*, a bushy shrub of the woodbine family, a native of North America, bearing white berries.

Snow-bird, a popular name applied to several species of birds, such as the *Montifringilla nivālis* of Europe, the *Fringilla hiemālis* of America, and the snow-bunting.

Snow-bunting, the popular name of *Plectrophenax nivālis*, a gregarious perching bird belonging to the finch family, a native of the Arctic regions. In winter it visits Britain and other temperate regions, and is supposed to be the harbinger of severe weather. It sings very sweetly, and does not perch, but runs about like the lark. Called also *Snow-fleck*.

Snowdon, a mountain of Carnarvonshire, North Wales, with five distinct peaks. It attains its greatest height in Snowdon (Y Wyddfa) proper—3560 feet—the highest point south of the Tweed, which may be reached by the Snowdon Railway from Llanberis.

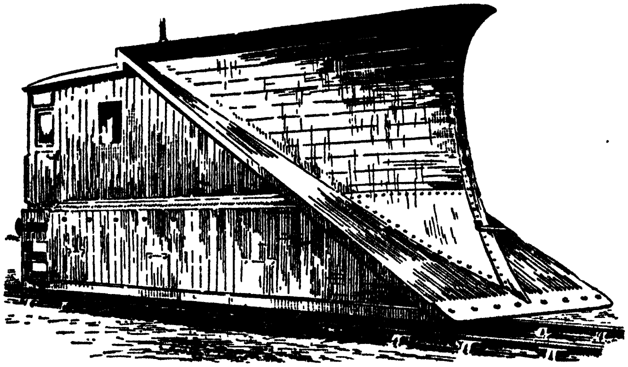
Snowdrop, a well-known garden plant of the genus Galanthus, the *G. nivālis*, nat. ord. Amaryllidaceæ. It bears solitary, drooping, and graceful white flowers, which appear in February. It is naturalized in Britain, and found in woods, orchards, meadows, pastures, &c.

Snowdrop Tree (*Halesia tetraptĕra* and *H. diptĕra*), a name of ornamental trees of the southern United States with flowers like snowdrops, belonging to the styrax family.

Snow-goose (*Chĕn hyperboreus*), a species of goose inhabiting the Arctic regions. Its flesh is esteemed excellent.

Snow-line. See *Snow*.

Snow-plough, a device used for the removal of the snow deposits on highways and railroad tracks. There is a difference in these two uses, as it is not always necessary to remove snow down to the actual road-level on a road, whereas for railway working not only must the snow be removed from above the rails, but the space beside the rails must be cleared away to allow the passage of the flanges of the wheels.



Single-ended Snow-plough, North-Eastern Railway

Scrapers drawn by horses may serve for the removal of loose snow on a road, but where heavy snow is encountered they are apt to rise. An adjustable plough-blade of about 10 feet length and 1 foot height, set at an angle of about 45° to the length of the motor-truck on which it is mounted, has proved an effective implement.

Where railways have to be constructed through countries where heavy falls of snow are to be expected, artifices such as running the lines on embankments rather than on the level in bad places are sometimes resorted to, and the erection of snow fences and sheds is also employed as a defensive measure. Wing ploughs or rotary ploughs, followed on the same truck by cutters for clearing the flangeways, are commonly used on railways. The rotary plough has a large wheel, 10 to 12 feet in diameter, on which blades are fitted to cut into the snow-banks. The snow that is cut from the bank must be thrown clear of the track, and consequently a high velocity must be imparted to it. A part of the equipment that is very useful is a steam hose to thaw out the wheel when it gets frozen up in the snowbank.

Snuff, a powdered preparation of tobacco inhaled through the nose. It is made by grinding, in mortars or mills, the chopped leaves and stalks of tobacco in which fermentation has been induced by moisture and warmth. The tobacco is well dried previous to grinding, and this is carried sometimes so far as to give to the snuff the peculiar flavour of the high-dried snuffs, such as the Irish, Welsh, and Scotch. Some varieties, as the rappees, are moist. The admixture of different flavouring agents and delicate scents has given rise to fanciful names for snuffs, which, the flavour excepted, are identical. Dry snuffs are often adulterated with quicklime, and the moist kinds with ammonia, hellebore, pearl-ash, &c. See *Tobacco.*

Snyders, Frans, Flemish painter, born at Antwerp in 1579, died in 1657. He studied the rudiments of his art under Breughel and Van Balen. Later he visited Italy, but in 1609 finally took up his abode at Antwerp, and died there. Snyders, who is considered never to have been surpassed in his delineation of dead game, fish, fruit, &c., excelled also in hunting-scenes and combats of wild animals. Some of his work was done in concert with Rubens. Choice pieces by Snyders are to be found in the collections at Munich, Dresden, and Vienna, in the Escurial, in the Louvre, and in some private English collections.

Soap is the name given to the salts of fatty acids such as palmitic, stearic, or oleic acids. The glyceryl esters of these acids occur in nature as the animal and vegetable oils and fats (see *Oils*; *Fat*). The soaps commonly used consist of the sodium or potassium salts; the former are known as hard, and the latter as soft soaps.

Soaps containing other metallic bases are only used for special purposes, e.g. lead oleate is used in medicine as a plaster, and aluminium stearate for thickening oils. Soap is commonly prepared by heating fats and oils with caustic alkalies. Thus if stearin (mutton fat) is boiled with a solution of caustic soda, the sodium salt of stearic acid (soap) is formed, together with the glycerine which was present in combination in the original fat. The raw materials employed are extremely numerous, animal oils and fats such as tallow, suet, lard, seal oil, and whale oil being largely used, and also coco-nut, palm, palm-kernel, cotton-seed, olive, linseed, and other vegetable oils. These usually require purifying and filtering before they are used for soap-making. The caustic lye is prepared either by dissolving the pure material in water, or by decomposing a solution of sodium or potassium carbonate with slaked lime and decanting the clear liquid after settling.

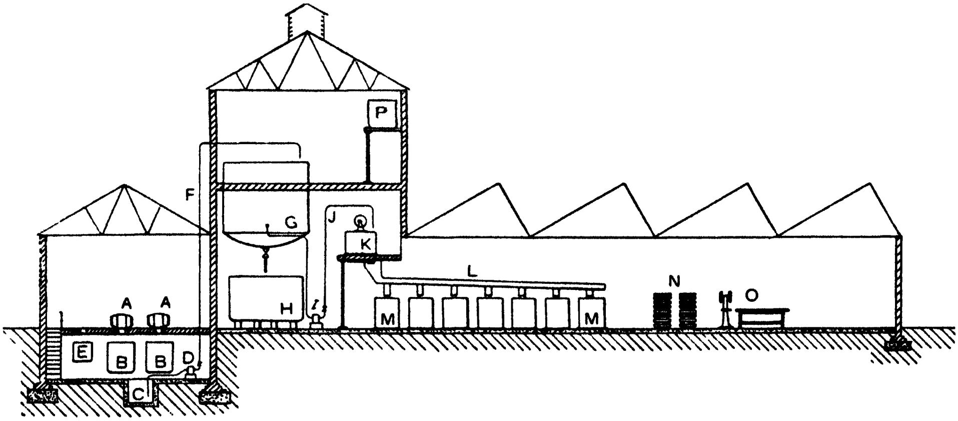
Hard soaps are made from the more solid animal and vegetable fats by treatment with caustic soda. For many purposes a small quantity of resin is also added to increase the transparency and also the lathering properties of the soap. The soap-boiling pans, which may hold as much as 30 tons, consist of wrought-iron plates riveted together in the form of a cauldron and fitted with perforated steam coils. At a higher level are placed storage-tanks containing, respectively, solutions of caustic soda and the melted fat. A small quantity of the lye is run into the pan and steam admitted into the coils; the melted fat is then added, and finally the requisite quantity of lye. As a rule about 14 parts of pure caustic soda are required for 100 parts of fat. The boiling is continued for several hours until the solution becomes transparent and is no longer alkaline. Common salt is then added, which has the effect of causing the soap to rise to the surface; this operation is known technically as *graining*. After standing for about twelve hours, the lower layer, consisting of a solution of salt and glycerine (q.v.), is run off for the recovery of the latter substance. The crude soap is then boiled up with a further quantity of caustic soda, to ensure complete saponification of the fat, and again treated with salt and separated from the lower layer. The soap is then *fitted* by boiling up with water until it becomes glossy and semi-transparent. After cooling for a few days it separates into two layers, the upper composed of good quality soap, whilst the lower layer consists of an inferior and darker-coloured variety termed *nigre*, which is used for the preparation of mottled soaps. The good soap is run off into moulds or frames and allowed to cool. When sufficiently solid, the blocks or slabs are removed, and cut into bars by means of a frame across which are stretched a number of parallel wires. These bars form the ordinary type of household soap. Manufacturer's soaps, such as the mottled and curd varieties, are usually prepared from the nigre which remains in the soap pan after the top layer has been removed. Crude fats and oils, such as currier's grease, brown tallow, or palm oil, are added to the pan, together with a sufficient quantity of caustic soda to saponify them. The contents are then boiled up and grained with salt as before.

The commoner kinds of *toilet soap* are made from ordinary household soap by adding colouring-matter and perfumes at as low a temperature as possible. They are often adulterated with alkaline carbonates, talc, clay, and water-glass. A soap prepared in this manner from coco-nut oil may contain as much as 70 per cent of water without in any way losing its hardness. The better qualities of toilet soap are made from white curd soap, which is cut into shavings and mixed in a crushing-mill with the colouring-matter and perfume. The mixed mass is then transferred to a pressing-machine, whence it is forced out in the form of a bar. This is cut up into pieces of the required size, which are then moulded and stamped.

Soft soaps, which are greasy and ointment-like, are made from cotton-seed, palm, sesame, rape, linseed, whale, seal, and cod oils, &c., by treatment with caustic potash. They differ from the hard soda soaps in that they contain the whole of the extraneous matter of the original oils, as well as the glycerine produced by their saponification, and the water necessary for the reaction. They are prepared in a similar manner to the hard soaps, but with a more concentrated lye. After the boiling has been started by means of live steam, the pan is generally heated by an open fire so as to avoid diluting the soap. If a small quantity of tallow is added to the oils used, whitish grains will appear in the soap after cooling. This is termed *figging*.

Silver or *elain* soap is a smooth soft soap resembling mother-of-pearl, which is prepared by treating oils with a mixture of potash and soda lyes. The sodium soap forms white shining stripes in the potassium soap, giving it its characteristic appearance. *Transparent* soap is made by dissolving dried soap in alcohol and allowing the impurities to settle; the alcohol is then distilled off and the residual soap pressed in moulds. *Castile* and *Marseilles* soap are prepared from olive oil by treatment with caustic soda. In certain cases soap may be prepared in the cold if a concentrated lye be employed. Lard, beef-marrow, and also coco-nut, palm-nut, and sweet-almond oil, are thus treated with caustic soda and allowed to saponify in the mould. Such soaps, which also contain glycerine, are often used for toilet purposes. In a similar manner soft *shaving* soap may be prepared by shaking up lard with a concentrated caustic potash lye in the cold.

In the modern soap industry efforts seem to be directed towards removing the glycerine from the fats and oils before converting them into soap, i.e. to decompose them into fatty acids and glycerine, to separate the latter, and then to neutralize the acids with sodium or potassium carbonate to form soap. The decomposition of the fats is usually carried out by treating them under pressure with superheated steam. By this means the glycerine, which is a valuable by-product, may be more readily obtained in the pure state, and the mixture of fatty acids separated into solid and liquid constituents suitable for conversion into various kinds of soap.—Bibliography: W. H. Simmons and H. A. Appleton, *Handbook of Soap Manufacture*; A. Watt, *Soapmaking*; G. H. Hurst, *Soaps: a Practical Manual.*



Elevation of a Soap Plant (reproduced by permission of Messrs. Lever Bros., Ltd.)

A, Barrels of oil to be melted out. B, Settling tanks. C, Measuring tank. D, Fat pump. E, Caustic dissolving tank. F, Oil-delivery pipe to soap pans. G, Soap-boiling pans. H, Lye tank. I, Soap pump. J, Soap-delivery pipe to crutcher. K, Soap crutcher. L, Soap chutes. M, Soap-cooling frames. N, Soap piled after being cut into bars. O, Soap stamper and wrapping table. P, Caustic and water tanks.

Soap-berry, the name applied to the fruit of several species of the genus Sapindus (nat. ord. Sapindaceæ) from their rind containing a saponaceous principle, so that when mixed with water they produce an abundant lather. The fruit is globular, as large as a cherry, enclosing a nut of a shining black colour when ripe.

Soap-plant, a name common to several plants used in place of soap, as the *Phalangium* (*Chlorogalum*) *pomeridianum*, a Californian plant, whose bulb, when rubbed on wet clothes, raises a lather, its smell somewhat resembling that of new brown soap.

Soapstone. See *Steatite*.

Soap-wort (Saponaria), a genus of plants of the nat. ord. Caryophyllaceæ; so called because the bruised leaves produce a lather like soap when agitated in the water. Common soap-wort (*S. officinālis*) is a native of many parts of Europe, and is found on waysides, river-banks, and thickets; in Britain it is found in alluvial meadows and under hedges. *S. calabrica* has numerous small pink flowers, and is one of the most beautiful flowers in English gardens.

Socage, or **Soccage**, in law, a tenure of lands in England by the performance of certain and determinate service: distinguished both from *knight-service*, in which the render was uncertain, and from *villeinage*, where the service was of the meanest kind. Socage has generally been distinguished into *free* and *villein*—*free socage*, where the service was not only certain but honourable, and *villein socage*, where the service, though certain, was of a baser nature.

Social Democrats, in most countries of Europe, the political representatives of Socialist thought. They believe that the existing economic organization of society, wherein production and distribution depend on private enterprise, regulated more or less by competition, is wasteful, oppressive, and unjust: wasteful, because private interest does not correspond to social utility; oppressive, because the majority of the people work under conditions which they have no voice in controlling; unjust, because it perpetuates inequality of opportunity and a distribution of wealth having no relation to desert or to need. Rent, interest, and profit, they say, are all unearned, and their private appropriation must be abolished by the social organization of economic activity and by the social ownership of the means of production. The present system is supposed to be moving in this direction, through the centralization of industry in the hands of a few capitalists, through periodic economic crises, and through the clash of economic interests (the class struggle) between the producing (proletariat) and owning (bourgeoisie) classes, which forces the former into organization in trade unions and labour parties, and ultimately into becoming sovereign in society.

As to the means to be employed for these ends, opinions have differed. At their appearance, in 1869, Social Democrats were revolutionary, but since 1890 they have been, in most countries, reformist, seeking to accomplish their purpose within the existing order by democratic constitutionalism. Since 1889 the various national parties have been united in the Second International. With the Russian Revolutions of 1917, a revolutionary tendency again showed itself. Parliamentary democracy was criticized as a disguise for capitalist dictatorship; the class struggle and the dictatorship of the proletariat were re-emphasized. Secessions have occurred in most countries, the reformists remaining within the Second International, the revolutionaries, who now call themselves Communists, forming a Third International (1919). In Great Britain the Democratic Federation (1880) became the Social Democratic Federation (S.D.F.) in 1883. In 1884 William Morris and H. M. Hyndman left the S.D.F. to found the Socialist League, but Hyndman later returned. In 1893 there was another secession, including Keir Hardie, which originated the Independent Labour Party. In 1912 the S.D.F. joined with several smaller bodies to form the British Socialist Party (B.S.P.). It opposed British participation in the European War (1914–8), but a minority, including Hyndman, broke away on this score and formed the National Socialist Party. This has since reverted to the name of Social Democratic Federation, while the B.S.P. has been merged in the Communist Party of Great Britain.

Socialism, a term loosely used to cover every device for the collective ownership by a community of the means of production, and their use for the benefit of the community as a whole. Various forms of socialism are known as *communism* (q.v.), which aims at complete equality and the holding of all property in common; *State socialism*, in which the State is regarded as the proper authority for conducting every branch of economic activity; and *guild socialism* (q.v.), akin to *syndicalism* (q.v.), which proposes to give to the workers in each branch of industry control over their own implements and conditions of work.

The beginnings of socialism may be traced back to the ideal commonwealths of Plato and Sir Thomas More; to Rousseau, who dreamed of political equality; and to Saint-Simon, who cared only for equality of wealth. The name of socialism, however, did not come into use until 1832, and it was then applied to communistic settlements, oases in the competitive desert, such as those founded by Robert Owen, Fourier, and Étienne Cabet. The modern movement of organized political socialism dates from the publication by Karl Marx, in 1848, of the *Communist Manifesto*, appealing to the workers of all countries to unite. Marx adopted from Ricardo a doctrine of value which, expressed in too absolute terms as an 'iron law of wages', seemed to explain the necessity, under the existing economic system, of keeping the workers in industry on bare subsistence wages, while the wealth of the community as a whole was rapidly increasing. Later economists have shown that Ricardo's theory requires considerable modification, or at least a different interpretation from that placed upon it by Marx, if it is to be accepted as valid. In his analysis of the wage system in modern industry, when it is uncontrolled by trade unionism or factory legislation, however, Marx is still held by the most scientific of modern Socialists to have been as right as he was impressive.

The effective Socialist movement in England dates only from 1881, and owes its intellectual stimulus to another economic theory expounded by Ricardo, the law of rent, which involves the appropriation by the owners of the 'unearned increment' in the value of land resulting from the social and economic progress of the community as a whole. (See *Rent.*) Basing himself on this doctrine, Henry George, in a lecturing tour (1881–2), advocated the nationalization of land, but seems to have converted many of his hearers to a wider socialism than he himself accepted. In the following year (1883) the Social Democratic Federation was formed by advocates of the whole socialistic programme (see *Social Democrats*), but no very strong movement has as yet grown up in this country, though there is a considerable tinge of socialism in the programme of the Labour party. It is indeed by taking practicable steps in the desired direction that the genius of the British people shows its political tendencies, and if we adopt this criterion of the progress of socialism, the advocates of that system may find much cause for satisfaction. In Great Britain, as in all the countries of Western civilization, there has been, during the last fifty years, a progressive extension of collective ownership and administration, either national or municipal, of such forms of industrial capital as railways, canals, telegraphs, telephones, postal communications, water, gas, electricity, and tramways. Simultaneously, there has been a steadily increasing regulation and control by the community of those great industrial enterprises which are still left to private ownership: Factory Acts, Mines and Railways Regulation Acts, Merchant Shipping Acts, Truck Acts, and Shop Hours Acts. Side by side with these measures there has been an increasing tendency to use the power of the State to levy taxation in such a way as to diminish inequalities of income between its citizens, and to make provision for those who are unable to provide for themselves: the aged, the sick, the unemployed, and children of all ages. By adopting measures such as these, we have departed altogether from the policy of *laisser-faire* (q.v.). On the other hand, these empirical steps in the direction of social organization are very far removed from the programme of revolutionary socialism which aims at the destruction of the existing mechanism of industry, and its supersession by a new order of society from which private enterprise and profit are rigidly excluded. How far the progress of social reform is to be attributed to the conscious efforts of avowed Socialists is indeed doubtful. There is much to be said for the view that the increasing complexity of modern society renders inevitable the development of social organization, and that the extreme proposals of advanced Socialists tend rather to retard progress, by arousing fears, than to expedite it. — BIBLIOGRAPHY: T. Kirkup, *History of Socialism*; J. Ramsay Macdonald, *The Socialist Movement* (Home University Library).

Social Psychology is that branch of psychology which deals with the mental life and modifications of consciousness resulting from the reciprocal relations of individuals in a community. It not only inquires into the modifications of the consciousness of the individual as it takes form in social relations and organizations, and describes the influence of the collectivity upon the activities of the individual, but it also concerns itself with the mental attributes of crowds and mobs. Social psychology thus deals with the modification of perception and emotion, idea and action, in so far as it is the result of social environment. It contrasts the mental characteristics of the individuals constituting a society or a group, and the modified mental attributes of a crowd which these individuals constitute. Social psychology is also concerned with the mental characteristics of different peoples and races. This subdivision of social psychology is known as race-psychology or folk-psychology (q.v.). Social psychology is to be distinguished from sociology (q.v.), which covers a more general and much wider field.—BIBLIOGRAPHY: W. M'Dougall, *Introduction to Social Psychology*; E. A. Ross, *Social Psychology*.

Society Islands, a French insular colonial establishment in Oceania. All the islands are volcanic, and the group is the administrative centre of French Oceania. Tahiti (q.v.) is the chief island. Moorea has an area of 50 sq. miles; pop. 2000. Phosphate is the staple product. Area of group, 637 sq. miles; pop. 20,000.

Society of Friends. See *Friends, Society of.*

Soci'nus, the latinized name of two celebrated theologians, uncle and nephew, who have given their name to a theological movement, known as Socinianism, "an intellectual and rationalist system of Christian doctrine on a supernatural basis", and known in its modified form as Unitarianism (q.v.).—Laelius Socinus (Lelio Sozzini), born in 1525 at Siena, in Tuscany, died in 1562, was destined for the legal profession, but abandoned jurisprudence for the study of the Scriptures. In 1546 he was admitted a member of a secret society at Vicenza, formed for the discussion of religious questions, which arrived at the conclusion that the doctrine of the Trinity was untenable, and that many of the dogmas of the Roman Catholic Church were repugnant to reason. The nature of their deliberations having become known, the society was broken up, several of its members put to death, and others, among whom was Socinus, fled the country. He visited France, England, Holland, &c., and resided for some time in Poland, where he found many persons who were in sympathy with his views. He is the author of *Dialogus inter Calvinum et Vaticanum, De Sacramentis, De Resurrectione Corporum*, and several unfinished works.—Faustus Socinus (Fausto Sozzini), a nephew of the preceding, born at Siena in 1539, died in 1604, was obliged to leave his native town in his twentieth year on account of his heretical opinions. His uncle bequeathed him his manuscripts, by the study of which he found his former opinions confirmed. He began to publish his views at Florence in anonymous writings, but afterwards retired to Basel to escape the Inquisition. His opinions were still more fully developed during a residence in Transylvania, and in Poland he had numerous adherents. See *Unitarianism.*—BIBLIOGRAPHY: H. M. Beard, *The Reformation of the Sixteenth Century in its Relation to Modern Thought*; A. Harnack, *History of Dogma*; T. M. Lindsay, *History of the Reformation.*

Sociology, a word first employed by Auguste Comte to denote the scientific study of society, or, as it is sometimes called, *social science.* Like most other sciences, this subject of study was systematically treated by the ancient Greeks. Plato and Aristotle were the founders of sociology. To them, however, the interests of the State were supreme, and the social problem consisted in the attainment of the most perfect life for the individual within those limits. Herbert Spencer, the greatest of modern sociologists, pointed out that while in an individual organism it is necessary that the lives of all the parts should be merged in the life of the whole, because the whole has a corporate consciousness capable of happiness or misery, it is not so with society. For in society the " living units do not and cannot lose individual consciousness, since the community as a whole has no corporate consciousness ". " This ", he said, " is an everlasting reason why the welfare of citizens cannot rightly be sacrificed to some supposed benefit of the State; but why, on the other hand, the State is to be maintained solely for the benefit of citizens." It has remained for more recent sociologists, like Benjamin Kidd, to bridge the gulf between Aristotle and Spencer by pointing out that " the social process is primarily evolving in the individual not the qualities which contribute to his own efficiency in conflict with his fellows, but the qualities which contribute to society's efficiency in the conflict through which it is gradually rising towards a more organic type ".

The study of human society is still an undeveloped science. It is only in quite recent times that the data upon which that study depends have begun to be systematically collected, and, even now, the difficulties which arise through lack of co-ordination of the methods employed in different countries in compiling statistics are very serious. Recent advances in human knowledge have tended rather to enlarge the scope of sociology than to develop intensively the field staked out by Herbert Spencer and his followers. Thus the remarkable progress in the study of heredity in plants and animals achieved by Professor Bateson and others, who have followed Mendel in patient investigation, has revealed a new aspect of sociology; while the application of psychology to social study by Professor Graham Wallas has initiated a new school of thought on these problems.

Sociology establishes a claim to be the master science. " As ", says Benjamin Kidd, " it is the meaning of the social process which in the last resort controls everything, even the evolution of the human mind and all its contents, so none of the sciences of human action, such as ethics, politics, economics, or psychology, can have any standing as a real science except it obtains its credentials through sociology by making its approach through the sociological method." It is the function of sociology to provide the ruling principles by which the results obtained in the various branches of social science may be brought into true relationship to one another.

A science with so vast a range necessarily has an immense literature bearing upon it. The beginner should read Herbert Spencer, *Study of Sociology*, a short elementary book, not to be confused with his *Principles of Sociology*; also Benjamin Kidd, *Social Evolution*; and Graham Wallas, *Human Nature in Politics.*

Soco′tra, or **Sokotra** (ancient **Dioscorides**), a British island in the Indian Ocean, a political dependency of Aden, forming the main island of a group comprising also Abd-al-Kuri, Kal Farun, and The Brothers (Darsa and Samha). Socotra proper is a mountainous island comprising a towering central massif (5000 feet) which rises from a limestone plateau of 1500 feet altitude. The plateau, furrowed by deep valleys, falls sheer to the north, but on the south there is a girdle of drift-sand. There are two seasons: (1) wet, between April and September; and

(2) dry, between October and April. In the low lands fever and tropical ailments are common. *People.*—The true Socotri are found in the mountainous hinterland; Arabs, Indians, &c., comprise the coastal population. Arabic is the lingua franca, and Mahommedanism is the universal religion, although the Socotri were, up to the seventeenth century, Nestorian Christians, and had at one time a Persian bishop. Tamarinda (Hadibu, pop. 500) is the capital. *Production.*—Ghee (an oil made from buffalo-milk butter-fat) is the main export; dates and milk are the staples. Cattle, sheep, and goats are kept in large numbers. The Socotra aloes are famous.

Socotra was the *Dioscorides* of the ancient Greeks and Romans. It was taken by the Portuguese in 1507, and abandoned again in 1511; but after the Suez Canal was opened it became a British station, and was formally protected in 1886. The Sultan of Kishin, to whose dominions Socotra belongs, has received an annual subsidy since 1876, and the Sultanate of Socotra is secured to his family through a viceroy.

Abd-al-Kuri lies west-south-west of Socotra. It is about 20 miles long by 3½ miles broad, and comprises a low central plateau flanked by hills. It is a barren, uncultivated waste, occupied by about 200 pearl-shell divers operating on the Bacchus Bank. *Kal Farun* lies west of Abd-al-Kuri, and comprises two rocks rising 300 feet sheer from the sea. They are bird-haunted and coloured white with guano. *The Brothers*, Darsa and Samha respectively, lie between Socotra and Abd-al-Kuri, and are united to the former by a shallow coral reef. Darsa has an area of about 4 sq. miles (1500 feet altitude), and Samha (18½ sq. miles) is a plateau about 2000 feet altitude. The names of The Brothers are rendered here phonetically.

Soc′rates (-tēz), Greek philosopher, born at Athens in or about 469 B.C., died in 399 B.C. His father, Sophroniscus, was a sculptor, and Socrates himself for a time followed this occupation. He served in the campaign of Potidæa (432–429 B.C.), fought at the battle of Delium (424), and in 422 marched with Cleon against Amphipolis. In these campaigns his bravery and endurance were conspicuous; and he was the means of saving the lives of Alcibiades and Xenophon. After the naval battle of Arginusæ (406) against the Spartans, ten Athenian officers were arraigned for neglecting the sacred duty of burying the slain. The clamour for their condemnation rose so high that the court wished to proceed in violation of all legal forms; but Socrates, the presiding judge at the trial, refused to put the question. Soon after he was summoned by the tyrannical Government of the Thirty to proceed with four other persons to Salamis to bring back an Athenian citizen who had retired thither to escape the rapacity of the new Government. Socrates alone refused. After this he declined to take any further share in public affairs, giving as a reason the warnings of an internal voice of which he was wont to speak. Following the promptings of this divine mentor, he trained himself to coarse fare, scanty clothing, and indifference to heat or cold, and brought into thorough subjection his naturally impetuous passions. But though a sage he was wholly removed from the gloom and constraint of asceticism; he indeed exemplified the finest Athenian social culture, was a witty as well as a serious disputant, and did not refrain from festive enjoyment. Of his wife Xanthippe, all that has passed into history is that she bore him three sons, and that she was an arrant shrew. Socrates wrote nothing, and neither sought to found a school nor a system of philosophy. His plan was to mix with men freely in any place of public resort, when he questioned and suggested the right path to real knowledge. Ignorance and pretence could not be hidden when his cross-examination came to bear on them, and he thus created many enemies. Aristophanes attacked him violently in his comedy of the *Clouds* as a Sophist, an enemy of religion, and a corrupter of youth. But he had many distinguished friends, such as Plato, Xenophon, Euclid of Megara, Antisthenes, Aristippus, Æschines, and Alcibiades. In 399 B.C. a formal accusation was brought against him by Anytus, a leading demagogue; Meletus, a tragic poet, and Lycon, an orator, charging him with not believing in the gods which the State worshipped, with introducing new divinities, and with corrupting youth. The trial took place before a law-court composed of citizen judges. His bold defence is preserved by Plato, under the title of *The Apology of Socrates.* He dwelt on his mission to convict men of their ignorance for their ultimate benefit; declared himself a public blessing to the Athenians, assuring them if his life were spared he would continue in the same course; and regarded the approach of death with utter indifference. He was condemned to death by a majority of his judges; refused help to escape, and thirty days after his sentence drank the hemlock cup with composure, and died in his seventieth year (399 B.C.). The account of his last hours is given in full detail in the *Phædo* of Plato. In their accounts of the life of Socrates the two principal authorities, Xenophon and Plato, substantially agree. It should be borne in mind, however, that Plato in his *Dialogues* generally presents his own thoughts through the mouth of Socrates, and that it is often difficult to discriminate between the Platonic and Socratic elements. While the previous philosophies consisted of vague speculations on nature as a whole, combining cosmology, astronomy, geography, physics, metaphysics, &c., Socrates arrived at the conclusion that the knowledge he had gained was of little practical value; and the speculations of philosophers, from Thales downwards, as to the origin of all things out of fire, water, air, &c., he regarded as profitless. Men's strivings after knowledge, he opined, should be directed to the human relationships as involving men's practical concerns. Self-knowledge is the condition of practical excellence. We fail to realize how little we know about anything, and this leads to considerable confusion. The real meaning of the Socratic " Know thyself " was therefore " Realize the extent of thine ignorance ". Socrates was the founder of a spiritual view of knowledge and conduct, defining as he did the soul as " that in us which has knowledge and ignorance, goodness or badness ". Goodness, according to Socrates, is knowledge, and the only man who knows the good is the philosopher. The latter knows that everything worth doing is so ' for the sake of the good alone '. Socrates introduced no formal system of ethics and no reasoned system of dialectics, but he paved the way for other philosophers to take up these subjects and work them out; and thus his teaching was the precursor of Platonism and the Aristotelian logic, and of all the often conflicting systems which rose into more or less importance for ten successive centuries.—BIBLIOGRAPHY: T. Gomperz, *Greek Thinkers*; E. Zeller, *Socrates and the Socratic Schools*; R. N. Cross, *Socrates: the Man and his Mission*; J. T. Forbes, *Socrates*.

Soda, a general term applied to various compounds of sodium in common use. Thus *sodium hydroxide* ($NaOH$), or *caustic soda*; *sodium carbonate* (Na_2CO_3), or *soda-ash*; *crystalline sodium carbonate* ($Na_2CO_3 10H_2O$), or *soda-crystals*, or *washing-soda*; *sodium bicarbonate* ($NaHCO_3$), or *baking-soda*, are all included under the term ' soda '.

Originally ' soda ' was entirely obtained from plants, especially marine and sea-shore plants. These were calcined, and from the ash crude ' soda ', known as *barilla*, was obtained. Later sodium hydroxide and sodium carbonate were prepared from sodium chloride by the *Le Blanc* or *salt-cake* process. This is now superseded by electrolytic processes and by the ammonia-soda process (see *Sodium Hydroxide*; *Solvay*).

Soda-ash is obtained by heating crude crystalline sodium carbonate to 100° C. to remove water of crystallization. Soda-ash is used in metallurgical processes.

Soda-nitre, Cubic Nitre, or **Chile Saltpetre,** mineral sodium nitrate ($NaNO_3$) found in commercial quantities only in the dry lands of the plateau of Tarapacá, in Northern Chile, where very important works are established for its extraction from the earthy layer in which it occurs. It is associated with potassium iodide and iodate, sodium sulphate and chloride, &c., and the unpurified material is styled *caliche*. Soda-nitre, on account of its nitrogen content (16 per cent) and its solubility in water, is exported as an agricultural fertilizer. It is also used in the manufacture of potassium nitrate (nitre) and nitric acid. See *Nitrate*; *Nitre*; *Nitric Acid*; *Explosives*.

Soddy, Frederick, British physicist and chemist, was born in 1877. He received his scientific training under Sir Ernest Rutherford in Montreal, and Sir William Ramsay in London. After holding a lectureship at Glasgow University and a professorship at Aberdeen, he went to Oxford in 1919 as Lee professor of inorganic and physical chemistry. Nearly all his work has been done on radio-activity. He was awarded the Nobel prize for chemistry in 1922.

Sodium, a chemical element (chemical symbol, Na; atomic weight, 23·00) widely distributed in the form of its compounds. It was discovered by Sir Humphry Davy in 1807. Previously the hydroxide of the metal ($NaOH$) was regarded as an element, but in that year Davy succeeded in decomposing sodium hydroxide by passing a powerful electric current through it, thus liberating sodium. Gay-Lussac and Thénard soon afterwards procured it in greater quantity by decomposing the hydroxide with metallic iron. It was manufactured afterwards by reducing sodium carbonate by distilling it with carbon. At the present day sodium is manufactured by the electrolysis of the fused hydroxide. Sodium is liberated at the cathode, and the hydrogen evolved at the same time protects it from oxidation.

Sodium is a silvery-white, soft metal. It has a high metallic lustre, its specific gravity is 0·971, and it melts at 97° C. It rapidly oxidizes in air or oxygen at ordinary temperature, losing its metallic lustre and becoming converted into the oxide. If thrown on to water, it decomposes the water immediately, with evolution of hydrogen gas and formation of a solution of sodium hydroxide. Sodium forms two oxides, *sodium monoxide* (Na_2O) and *sodium peroxide* (Na_2O_2). The former is obtained if sodium is burned in a limited supply of oxygen; the latter is the more easily formed, and is produced when sodium is heated in a stream of air or oxygen. Sodium burns rapidly in oxygen with an intense yellow flame. On account of its affinity for oxygen and its action on water, sodium metal is always kept under mineral naphtha.

The metal is used as a reducing agent in the manufacture of certain organic compounds, such as indigo, synthetic drugs, &c.

Sodium in the form of its compounds is one of the most abundant of the metals: it is present in all soils; in many naturally occurring silicates, *such as felspar* and *orthoclase*; in Chile saltpetre ($NaNO_3$); &c. Its most abundant compound is *sodium chloride* or *common salt* (NaCl), which occurs in sea-water and in large deposits of rock-salt in many parts of the world.

Many of the salts of sodium are important; hard soaps are sodium salts of certain fatty acids. See *Soap*; *Salt*; *Rock-salt*; *Soda-nitre*; *Sodium Bicarbonate*; *Sodium Carbonate*; *Sodium Hydroxide*; *Borax*; *Glauber's Salt*.

Sodium Bicarbonate ($NaHCO_3$) is prepared by the *ammonia-soda* process (see *Solvay*) from sodium chloride, the crude sodium bicarbonate being purified by recrystallization. It forms small colourless crystals less soluble in water than the normal carbonate (Na_2CO_3). It decomposes on heating, loses carbon dioxide, and is converted to the normal carbonate: $2NaHCO_3 = Na_2CO_3 + H_2O + CO_2$. It is used medicinally, and as a raising material in baking.

Sodium Carbonate (Na_2CO_3) is prepared from sodium chloride, ammonia, and carbon dioxide by the *ammonia-soda* process (see *Solvay*), and electrolytically. It is a white crystalline solid soluble in water, giving an alkaline solution. The crystals, which contain 10 molecules of water, effloresce in air, and fall to a white powder. It is a good detergent, and is therefore used in laundries and in scouring textiles. It is used in the soap and glass industries, and in the preparation of sodium salts.

Sodium Hydroxide, or Caustic Soda (NaHO), is a white solid very soluble in water or alcohol. It has strongly basic properties, and neutralizes acids, forming salts. It has a corrosive action on animal and vegetable tissues. Cotton fabric dissolves readily in a solution of caustic soda; and if cotton is treated for a short time with a dilute solution, it acquires a bright lustre resembling silk, and is said to be mercerized. Caustic soda is used in many industries, as in the manufacture of soaps, in the paper industry, and in the preparation of dyes. It is manufactured by the electrolysis of a solution of sodium chloride.

Sodom, a city of Palestine, the principal of the five cities (Sodom, Gomorrah, Admah, Zeboïm, and Zoar) described in *Genesis* as the cities of the plain (i.e. of Jordan). They were overthrown on account of the wickedness of the inhabitants (*Gen.* xix), with the exception of Zoar, which was spared at the supplication of Lot.

So'doma (or So-dŏ'ma), **Il**, the usual name of *Giovanni Antonio Bazzi*, an Italian painter, born at Vercelli 1477, died in 1549. He was strongly influenced by Leonardo, and worked in Rome, but mainly in Siena, where he can be best studied.

So'fia, or So'phia, the capital of Bulgaria, is situated in a plain on the River Bogana, near the foot of the north side of the Rhodope Mountains. There are mineral-springs in the vicinity; industries include: cordage, soap-making, tanning, brewing, furniture-making, and manufactures of sugar, pottery, and cement. Sofia was founded by the Emperor Justinian on the ruins of the ancient *Sardica*. It was taken by the Turks in 1382, and remained in their possession till 1878, when it was captured by the Russians and became the capital of Bulgaria. Pop. 100,000.

Soil, mould, or that compound earthy substance which is particularly adapted to support and nourish plants. Wherever the surface of the earth is not covered with water, or is not naked rock, there is a layer of earth more or less mixed with the remains of animal and vegetable substances in a state of decomposition, which is commonly called the *soil*. In uncultivated grounds soils generally occupy only a few inches in depth on the surface; in cultivated grounds their depth is generally the same as that to which the implements used in cultivation have penetrated. The stratum which lies immediately under the soil is called the *subsoil*, and this is comparatively free from organic matter. The soil-grains supply by their slow decay substances needed in plant-growth; but the structure and texture of the soil are fully as important as its chemical composition. The interspaces between the grains are filled with air and water, and should not be too small to allow of free percolation, nor so large as to lead to drought. Important reactions take place between the chemical solutions in the soil and the surface of the finer soil-particles.

Soils and Manures. Soils are derived from the disintegration of various geological formations. The chief forces producing these changes have been erosion by glacial action or by running water, disintegration by frost, and decomposition by moist air. Soils are either *sedimentary*, i.e. they lie upon the rock from which they are formed, or are *transported*, i.e. carried down and deposited by glaciers or rivers. Chalk, sandstone, limestone, and clay soils are examples of the first class. The second class includes boulder clays and alluvium. According to the preponderance of certain organic or mineral substances, soils are termed clay, sandy, calcareous, gravelly, or peaty soils (see *Loam*). For a soil to possess fertility the following conditions are all essential: (1) a sufficiency of available plant-food, (2) a suitable texture, (3) a porous subsoil, (4) an adequate supply of moisture and sunlight, and (5) the absence of substances injurious to plant-life.

Manures.—Substances of various origin added to the soil, chiefly for the purpose of supplying those kinds of plant-food that are either lacking or scanty; also serving, in some cases, to improve the texture and other physical characters. *General* or *complete manures* contain all the necessary constituents. Farmyard manure (dung) is the most important of these, but composts are also of value, especially for horticulture. Night soil, sludge, and green manures are further examples. *Special* manures supply one or two important sorts of plant-food, and they comprise the following: (*a*) *Nitrogenous manures.* Nitrate of soda, nitrate of lime, nitrolim, sulphate of ammonia, waste animal substances (blood, horns and hoofs, shoddy, &c.), and vegetable matter (oil-seed residues). (*b*) *Phosphatic manures.* Superphosphate, basic slag, various bone preparations. (*c*) *Potassic manures.* Kainite, muriate of potash, sulphate of potash. (*d*) *Calcareous manures.* Quicklime, and calcium carbonate in various forms. Manures are usually distributed over the surface of the land and then ploughed or harrowed into the soil; or they may be applied in drills when the object is to give direct benefit to the young plant. The kind of manure required for each crop depends on the nature of the crop, the quality and composition of the soil, and many other conditions. In the production of food by natural processes of plant-growth a certain amount of mineral food is abstracted from the soil, the amount and kind varying for different species of plants; if this food be returned to the soil, then a further growth of plants may be expected; if, however, seed is sown in the partially impoverished soil, there must be a decrease in the amount of crop obtained from that soil. As the plants serve to nourish animals, it follows that the substances which have been withdrawn from the soil by the plants may be returned to it in the shape partly of animal excreta, and partly of ground bones, &c. Different plants require different kinds of food; if, therefore, the kind of crop grown on the same land be varied from year to year, and if the soil be tilled so as to unlock its natural supplies of mineral food, it will be found that the average yield of crops may be maintained simply by the restitution to the land of that amount of food which has been removed from it by the plants. It should also be noted that nitrogenous plant-food is added to the soil by the activity of nitrogen-fixing bacteria, some free-living, and others contained in nodular swellings on the roots of leguminous plants. The theory of manuring consists, then, in maintaining in the soil such an amount of plant-food as shall enable us to reap the largest possible amount of crops from that soil.

Soissons (swȧ-sōṇ), a city of France, one of the oldest towns in the country, in the department of the Aisne, on the River Aisne. It is a fortress of the second rank, and was taken by the Germans in 1870 after four days' resistance. It was held by the Germans after the passage of the British troops (retreating from Mons) in 1914. They retired on 12th Sept. and bombarded the town, destroying the cathedral, &c. In May, 1918, the Germans again took Soissons, but were compelled to evacuate it again on 2nd Aug. Pop. 12,000.

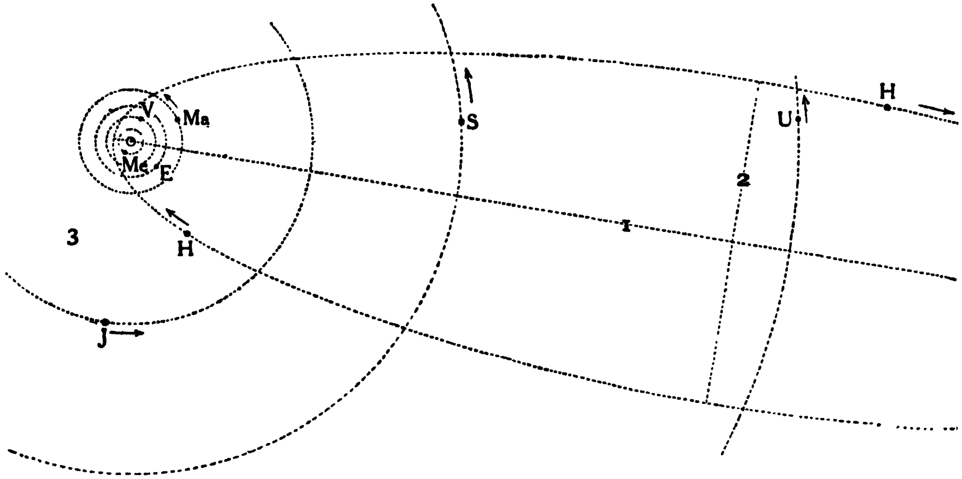
Soja Bean, or **Soya Bean** (*Glycine hispida*), a leguminous herb, native of Eastern Asia. The fermented seeds yield *soy*, a favourite Chinese condiment, and *natto*, a Japanese cheese or curd-cake. After expression of the oil, the beans are used as cake for cattle-feeding.

Sokol, a Czech word meaning falcon, and adopted as the name of a patriotic organization, a gymnastic union formed under the leadership of Miroslav Tyrsh and Jiudrich Fügner. The first general meeting of the union was held at Prague, on 16th Feb., 1862. The Sokol unions continued to develop, as an expression of the spirit of race, and fostered the aspirations of Czech nationality. The spirit which gave birth to the Sokol movement was destined to bear fruit after the European War, when, after the emancipation of Bohemia, the Czecho-Slovak Republic was established.

Solana′ceæ, a natural order of gamopetalous dicotyledons, composed of herbs or shrubs, natives of most parts of the world, and especially within the tropics. They have alternate leaves, terminal or axillary inflorescence, and regular, or nearly regular, flowers. The nightshade, potato, capsicum, tomato, egg-plant, and tobacco are all of this order, the typical genus being Solānum, which contains the potato, bittersweet, egg-plant, and numerous other species.

Sol′anine, a vegetable alkaloid obtained from various species of Solānum, as *S. Dulcamāra*, *S. nigrum*, *S. crispum*, &c. It forms a crystalline powder, very bitter and acrid, and highly poisonous. It is insoluble in water, but dissolves in alcohol. With acids it forms salts, which are uncrystallizable.

Solar Engine, a type of engine making use of steam generated by the utilization of the heat of the sun. In his presidential address to the British Association in 1909, Sir J. J. Thomson stated that the heat received by the earth under a high sun and a clear sky is equivalent, according to the measurements of Langley, to about 7000 h.p. per acre. There are considerable difficulties attending the design of plant for the effective utilization of this enormous source of power, but one actual plant, which, it is said, was used in a test to pump 3000 gall. of water per minute to a height of 33 feet, was constructed a few years ago by Frank Shuman of Philadelphia. This plant was later delivered for use in Egypt. The steam-generating plant consists of steel troughs suitably insulated with granulated cork and covered with two layers of glass with an air-space between them. Parabolic reflectors made of silvered glass, and each about 200 feet long, are used to reflect the sun's rays through the glass tops on the water-vessels. The mirrors are turned to face the sun at all times by power derived from the plant. Only a thin film of water is used in the troughs, and the steam generated from it is passed to a low-pressure steam-engine provided with an efficient condenser. The inventor claims a great advantage in cost of power generation over an ordinary coal-fired plant.



Orbits of Planets and Halley's Comet

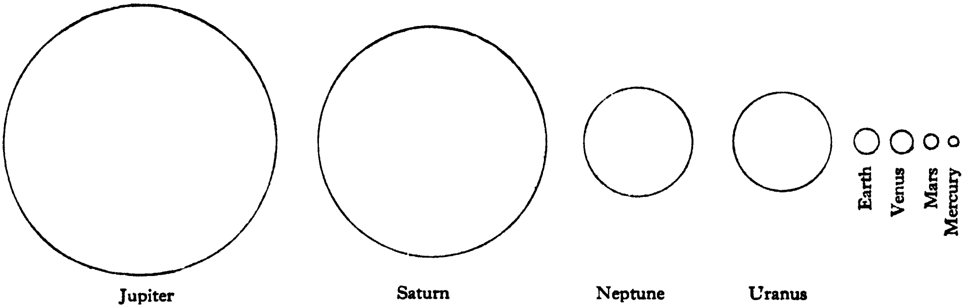
Scale 1 inch = 510,000,000 miles. On this scale the nearest star would be about three-quarters of a mile away. 1, Major axis of cometary orbit. 2, Minor axis. 3, Orbits of minor planets here.

Solar System. The Solar System is the name given to designate collectively the Sun and the group of bodies which revolve round it. These consist of planets, comets, and meteors. The planets are comparatively cool and dense bodies, and shine by reflecting the light of the Sun. Eight major planets are known, which, in order of distance from the Sun, are named Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. There is also an enormous number of diminutive asteroids, or minor planets, revolving between the orbits of Mars and Jupiter. It is not likely that any planet exists within Mercury's orbit, but the future discovery of one or more beyond Neptune seems quite possible. Most of the major planets have attendant upon them one or more moons or satellites, called also secondary planets. The largest planet, Jupiter, weighs more than double all the others combined, but the Sun's mass exceeds that of all the planets more than 700 times; it therefore forms a very stable centre for the system.

		Distance from Sun (million miles).	Revolution Period.	Diameter in Miles.
Me	Mercury	36	88 days	3,000
V	Venus	67	225 ,,	7,600
E	Earth	93	365 ,,	7,918
Ma	Mars	141	2 years	4,200
J	Jupiter	483	12 ,,	87,000
S	Saturn	886	29½ ,,	73,000
U	Uranus	1782	84 ,,	32,000
H	* Halley's Comet	(1) 55 (2) 3300	76 ,,	——
	† Neptune	2792	165 ,,	35,000

(1) Perihelion distance. (2) Aphelion distance. * Motion retrograde. † Not shown.

The comets are extremely diffuse objects, but in some cases they are of stupendous size, so that, while insignificant in mass, they occasionally vastly exceed the Sun in bulk. They have generally orbits of high eccentricity. Comets shine partly by reflected light, but are also self-luminous. Meteors are extremely small bodies of metallic or stony composition. They become visible only when they enter our atmosphere, and are rendered incandescent through friction. They travel largely in shoals or streams, which are believed to represent the debris of disintegrated comets. As Neptune revolves at 2,800,000,000 miles from the Sun, the planetary system measures at least 5,600,000,000 miles across, but some comets belonging to the Sun's family recede to much remoter regions. Although the Nebular Hypothesis (q.v.), as conceived originally by Laplace, has latterly been found inconsistent with many features of the Solar System, it is generally accepted that the material which has gone to form the Sun, planets, comets, and meteors was once extended in a widely diffused or nebulous form, and that it became aggregated mainly into the large masses of the Sun and planets, while the comets and meteors are, so to speak, the chips and shavings left over in this vast work of world construction. The Sun, carrying with it its mighty retinue of subject bodies, is travelling constantly at the rate of about 12 miles a second in a direction approximately towards the bright star Vega. See *Astronomy*, &c.



Relative Sizes of the Planets

Scale 1 inch = 61,000 miles. The Sun's diameter is about ten times Jupiter's

Solar Time, time as indicated by the sun. True, or *apparent*, solar time as shown by a sundial is not strictly uniform. An average, or *mean solar*, time is therefore used for ordinary purposes. See *Day*, *Equation of Time*.

Soldanella, a genus of plants, nat. ord. Primulaceæ. The species are small herbs, natives of alpine districts of continental Europe. One of them, *S. alpina*, a native of Switzerland, with lovely blue flowers, is well known as an object of culture.

Solders, metallic cements or fusible alloys used for joining metals together. The solder should always be more fusible than the metals which it is to unite, and should possess about the same hardness and malleability as these. Hard solders are ductile, will bear hammering, fuse at a relatively high temperature, and are commonly prepared by mixing a portion of the same metal it is required to unite with some other in order to lower its temperature of fusion. Under this head comes the hard solder for gold, which is prepared from gold and silver, or gold and copper, or gold, silver, and copper. The hard solder for silver is prepared from a mixture of silver and brass. The hard solder for brass is obtained from brass containing about 50 per cent of copper and 50 per cent of zinc, which may also be used for the hard solder of copper, and is commonly known as brazing solder. The soft solders melt easily, and are used for soldering metals with low melting-points, such as lead, tin, &c. Of this kind are the following mixtures: tin and lead in equal parts; tin, two parts, lead one part; tin, one part, lead, two parts; bismuth, tin, and lead in equal parts; one or two parts of bismuth, of tin and lead each one part. In soldering, the surfaces to be united must be made perfectly clean and free from oxide. This is commonly effected by scraping the surfaces; and, in order that the formation of any oxide may be prevented during the process, borax, sal ammoniac, zinc chloride, commonly known as killed spirit, or resin is used, either mixed with the solder or applied to the surfaces.—*Autogenous soldering* is the union of two pieces of metal without the intervention of any solder, by fusing them at the point of junction by means of a blowpipe flame.

Soldier-beetle, a name given to carnivorous beetles of the genus Telephorus, from their reddish colour and their combativeness.

Sole (*Solĕa vulgāris*), a marine fish belonging to the Pleuronectidæ or flat-fishes, of an oblong or oval form, and with both eyes on the right side, which is pigmented and turned upwards. These fishes abound on the British coast, and also *on all the coasts of* Europe except the most northern, where the bottom is sandy. They furnish a wholesome and delicious article of food. They sometimes ascend rivers, and seem to thrive quite well in fresh water. The sole sometimes grows to the weight of 6 or 7 lb. The name is also given in America to certain other flat-fishes. The sole is at its worst from February to the end of March, this being the spawning season. It is usually captured by the trawl-net. The closely allied sand-sole, French sole, or lemon sole (*S. lascaris*) is much less valuable as a food fish.

Solenoid, a cylindrical coil of wire through which a current is passed to produce a magnetic field. The major number of the lines of force pass through the coil in a direction parallel to the axis. Such a device resembles in action the simple magnet. The number of lines of force passing through the space inside the coil is a maximum at the centre, for the lines due to all the turns are operative there. A piece of iron would be drawn into this centre position, and this is used in the construction of many electromagnetic appliances, such as the overload trip operating gears in motor starters, and in those ammeters and voltmeters known as soft-iron instruments. The pull exerted by a solenoid may be calculated from the current passing, the number of turns of wire in use, and the dimensions of the coil. When a solenoid is of great length compared with its diameter, only about half the magnetic lines pass out at the ends, the others taking directions through the cylindrical surface of the coil.

So′lent, that part of the English Channel separating the north-west shore of the Isle of Wight from the mainland of Hampshire, and extending between the Needles and West Cowes. It has a width varying from 2 to 5 miles, and affords a safe and well-sheltered roadstead.

Soleure (so-*leur*; Ger. *Solothurn*), a canton of Switzerland; area, 306 sq. miles. It is traversed throughout by the Jura. The whole canton belongs to the basin of the Rhine, which receives the greater part of its drainage through the Aar. The inhabitants are mostly German-speaking Roman Catholics engaged in agriculture.

Soleure, a city of Switzerland, capital of the canton of Soleure, on the Aar. It is a railway junction and a watch-making centre. Pop. 12,000.

Solferi′no, a village and commune of Italy, in the province of Mantua. In 1796 the Austrians were defeated by the French at Solferino prior to the siege of Mantua; and here also, on 24th June, 1859, a battle was fought between the allied French and Sardinians (under the direction of Napoleon III) and the Austrians, resulting in the defeat of the latter, and the subsequent Treaty of Villafranca. Pop. 1700.

Solicitor, a legal practitioner whose business it is to commence, carry on, or defend suits at law on behalf of persons who employ him, and who usually also carries on conveyancing and other non-contentious business. In England the term was formerly applied distinctively to agents practising before the courts of chancery, attorneys being those who practised in the courts of common law; but by the Judicature Act of 1873 all persons practising before the supreme courts are called solicitors, and the term attorney is practically obsolete. Solicitors act as advocates for their clients in the inferior courts, but barristers take this duty in the higher courts. (See *Barrister*.) In 1919 an effort was made to bring about a fusion between solicitors and barristers, but the scheme was opposed and defeated by the Law Society. The Sex Disqualification (Removal) Act, 1919, made women eligible as solicitors. A solicitor may sue for his fees, and he has a lien over his client's papers in his possession for his proper costs. The client may require the costs to be taxed. A solicitor is liable in damages to a client who has sustained loss through his negligence or want of skill. Solicitors have annually to take out a certificate and pay a licence duty of £6 (or £9 if practising in London).

Solicitor-general, an officer of the British Crown, next in rank to the attorney-general, with whom he is in fact associated in the management of the legal business of the Crown, and public offices. He is a member of Parliament, but not of the Cabinet, and receives a salary of £6000. The solicitor-general for Scotland is one of the Crown counsel, next in dignity and importance to the lord advocate.

So′lingen, a town of Prussia, in the Rhine province, with manufactures of iron and steel ware, especially cutlery. Pop. 50,500.

Solipsism (*solus*, alone, *ipse*, self), a philosophical term applied to the doctrine that nothing but the self exists, that immediate knowledge is only the self and its ideas; that only the ego and the mind of the thinker are real, whilst the independent existence of an external material world is doubtful. Solipsism is thus subjective idealism, which in its subjectivity excludes the belief in objectivity.

Solis, Antonio de, Spanish poet and historian, born 1610, died 1686. He was appointed Historiographer of the Indies, and published his *Historia de la Conquista de Mejico*, which passed through many editions, an English translation being published in 1724.

Solitaire, a bird belonging to the dodo family (Dididæ), but having a smaller bill and shorter legs. *Pezophaps solitarius*, the only species of whose existence there is any evidence, is now, like the dodo, extinct, and became so since 1691, when the Island of Rodriguez, situated about 300 miles to the east of the Mauritius, where alone it was found, was first inhabited.

Solmization, in music, an exercise for acquiring the true intonation of the notes of the scale, first by singing them in regular gradation upwards and downwards, and then by skips over shorter or longer intervals. To facilitate this various expedients have been devised, the most popular being the association of the several sounds with certain syllables, such as *ut, re, mi, fa, sol, la,* said to have been first used by Guido of Arezzo in the eleventh century—an additional syllable, *si*, for the seventh of the scale, being introduced at a much later date. In the tonic sol-fa method these syllables are thus modified —*doh, ray, me, fah, soh, lah, te.* See *Tonic Sol-fa.*

Solomon (Heb. *Shelōmōh*, the Prince of Peace), son of David, King of Israel, by Bathsheba, formerly the wife of Uriah. He was appointed by David to be his successor in preference to his elder brothers. Solomon was renowned for his wisdom and for his wealth; and by the building of the temple he bound the nation strongly to the throne. Fortune long seemed to favour this great king; and Israel, in the fullness of its prosperity, scarcely perceived that he was continually becoming more despotic. Contrary to the Laws of Moses, he admitted foreign women into his harem; and from love of them he was weak enough in his old age to permit the free practice of their idolatrous worship, and even to take part in it himself. Towards the close of his reign troubles arose in consequence of these delinquencies, and the growing discontent, coming to a head after his death, resulted in the division of the kingdom, which his feeble son Rehoboam could not prevent. The forty years' reign of Solomon is still celebrated among the Jews, for its splendour and its happy tranquillity, as one of the brightest periods of their history. The writings attributed to Solomon are *The Book of Proverbs, Ecclesiastes,* and *The Song of Solomon,* with the apocryphal book *The Wisdom of Solomon*; but modern criticism has decided that only a portion of *The Book of Proverbs* can be referred to Solomon.

Solomon Islands. (1) A dependency of Mauritius. (2) An Australian mandatory group, formerly a part of German New Guinea. It comprises the mountainous Islands of Bougainville and Buka, which form the administrative district of Kieta. Kieta, on Bougainville, is the Government station, and has a good harbour. Bananas, coco-nuts, taro, and sweet potatoes are raised. Pop. 15,800 (Buka about 6800, and Bougainville about 9000). (See *New Guinea.*) (3) A British Pacific protectorate, comprising the Islands of Guadalcanar, Malaita, Isabel, San Cristoval, New Georgia, Choiseul, Mono (or Treasury), Shortland, Vella Lavella, Ronongo, Rendova, Russell, Florida, Rennell, and other islands, and including the Lord Howe (Ontong-Java), Santa Cruz, and Duff (or Wilson) groups, and Tucopia and Mitre Islands. Area, 11,000 sq. miles; pop. 150,000. Sweet potatoes, pineapples, bananas, rubber, and coco-nuts are produced.

Solomon's Seal, the common name of plants of the genus Polygonătum, a genus of liliaceous but not bulbous plants, with axillary cylindrical six-cleft flowers, the stamens inserted in the top of the tube, and the fruit a globose three-celled berry. Species are found in England and Scotland, as well as on the Continent.

Solomon's Seal

Solomon's Song (called also the *Song of Songs*, or *Canticles*), one of the canonical books of the Old Testament. From the earliest period this book has been the subject of voluminous controversies. It seems to have been a recognized part of the Jewish canon in the time of Jesus. Till the beginning of the nineteenth century the author of the book was almost universally believed to be Solomon. Certain critics, however, attribute it to an author of Northern Israel, who wrote it about the middle of the tenth century B.C., shortly after the death of Solomon, in a spirit of protest against the corrupt splendour of the court of Zion. The unity of the poem is sufficiently evidenced by the continuity of names, characters, and subject, and is taken for granted by the majority of critics. The main subject of dispute has been as to its interpretation. The various theories in regard thereto fall into two classes, the literal and allegorical. The highest form of allegorical significance contended for is the mystical or spiritual interpretation, by which the whole poem becomes a figurative representation of the hopes and aspirations, together with the trials and difficulties, of a spiritual life. This interpretation, whether applied individually or collectively to the Church or nation of Israel, was almost universally received both by Jews and Christians until recent times. The most favoured literal interpretation is that the poem represents the temptation and triumph of virtuous love. The supporters of an allegorical interpretation urge the frequency with which the marriage relation is employed, in the Old and New Testament, to represent the relation of Jehovah to Israel, and of Christ to the Church. Recent criticism sees in it a collection or anthology of songs anciently used at marriage festivals.—Bibliography: A. Harper, *Song of Solomon*; E. C. Martin, *Song of Songs*; E. Renan, *Le Cantique des cantiques.*

Solon, Athenian lawgiver and statesman, one of the seven wise men of Greece, born about 638 B.C., died about 558 B.C. He was of good family, and acquired a wide knowledge of the world in commerce and travel. One of his earliest public transactions was in stirring the Athenians up to the recovery of Salamis, after which he was chosen chief archon (594 B.C.) and invested with unlimited powers, the state of parties in Athens being such as to threaten a revolution. He established a new constitution, divided the citizens according to their wealth, and added to the powers of the popular assembly. He made many laws relating to trade and commerce. He either entirely abrogated all debts, or so reduced them that they were not burdensome to the debtors; and abolished the law which gave a creditor power to reduce his debtor to slavery. When he had completed his laws, he bound the Athenians by oath not to make any changes in his code for ten years. He then left the country, to avoid being obliged to make any alterations in them, and visited Egypt, Cyprus, and other places. Returning after an absence of ten years, he found the state torn by the old party hate; but all parties agreed to submit their demands to his decision. It soon became evident, however, that Pisistratus would succeed in seizing the sovereignty, and Solon left Athens. Though Athens now fell under the despotic rule of Pisistratus, much of Solon's legislation remained effective.

Solo Whist, a variety of whist akin to the American game of *Boston*, was introduced into Britain from Holland towards the middle of last century. It resembles ordinary whist in being played by four players with a full pack of cards; the values are as in whist, but the trump suit gives no 'honours'. One player can 'propose', and a second 'accept', the taking of eight tricks in partnership; or one player can undertake the gaining of five tricks with his own hand ('solo'), the other three then combining against him. *Misère* is the undertaking by one player not to take a single trick; *abondance* that of making nine tricks by his unassisted hand. Other allowable declarations of the same nature are *misère ouverte* and *abondance déclarée.*—Bibliography: Green, *Solo Whist*; Wilks, *Handbook of Solo Whist.*

Solstice, in astronomy, one of the points in the ecliptic at the greatest distance from the equator, at which the sun appears to stop or cease to recede from the equator, either north in summer or south in winter. There are two solstices—the summer solstice, the first degree of Cancer, where the sun is about 21st June; and the winter solstice, the first degree of Capricorn, where the sun is about 22nd Dec. The time at which the sun is at either of these points also receives the same name.

Solution. The liquid obtained by dissolving salt or sugar in water may be taken as an example of a solution. The water is called the solvent, and the salt or sugar the solute. A solute may be formed from a solid, a liquid, or a gas; a solvent is usually a liquid, though crystals, such as the alums and certain alloys, may be solutions of one solid in another.

The mass of solute which will dissolve in 100 parts of solvent defines the solubility. It depends chiefly on the nature of the solute and of the solvent, all degrees of solubility being found. The solubility of an inert gas is proportional to the pressure (Henry's law); carbon dioxide, dissolved under pressure, comes out of mineral-waters when the pressure is relieved. Solubility also depends on temperature, that of gases generally diminishing and that of liquids and solids increasing as temperature rises, and faster at high temperatures than at low.

A saturated solution, in which no more solute will dissolve, is in equilibrium at a given temperature. The conditions necessary for equilibrium were studied theoretically by Willard Gibbs, on the general principle that as a plumb-line comes to rest when the lead is at the lowest point, so any system tends to decrease its available energy and attains equilibrium when that energy is a minimum.

Phase Rule.—The results obtained by Gibbs are formulated in the 'phase rule'. A *phase* may be defined to be a part of the system of uniform composition throughout. Water-substance, for example, may exist in the three distinct phases of ice, water, and water-vapour; these are said to be phases of the one *component* water. Two components, say water and common salt, may occur in many phases, e.g. crystals of ice, crystals of salt, and a saturated solution of the salt in water. The phase rule states that the number of degrees of freedom in a system, i.e. the number of independent ways in which the constitution and physical state of the system may vary, is $c - p + 2$, where c is the number of components, and p is the number of phases present in the system. Hence, if there is no freedom, or, in other words, if the system has arrived at a definite state of equilibrium, we must have $c - p + 2 = 0$, or $p = c + 2$, so that the number of phases present must exceed the number of components by two. Thus, when water, ice, and water-vapour are in equilibrium in presence of each other, $c = 1$, and $p = 3$, so that $p = c + 2$, and there is no freedom; in the present case this means that the pressure and temperature are definitely fixed, as it is easy to see otherwise must be the case, the temperature being the freezing-point of water under the pressure of its own vapour. If, however, only two phases are present, say water and water-vapour, $c = 1$, $p = 2$, and the number of freedoms is $1 - 2 + 2$, or 1; the pressure, e.g., may be taken arbitrarily, but the temperature is then determinate.

The phase rule is of practical importance, and is much used by chemists, as, for instance, in the separation of one salt from another at the Stassfurt mines.

Osmosis and Osmotic Pressure.—When two liquids are separated by a porous membrane, they do not usually diffuse through the membrane at the same rates. The Abbé Nollet (1748) tied a piece of skin over the mouth of a phial filled with alcohol, and immersed the phial in water. After some hours he found the skin distended, showing that the water which had passed into the phial exceeded in volume the alcohol which had passed out. The phenomenon is called *osmosis*. By forming precipitates in the walls of a porous pot, semi-permeable membranes may be formed, pervious to one liquid but not to another, or pervious to solvent but not to solute. Into such a pot, filled with solution, water will enter till a definite equilibrium pressure, called the *osmotic pressure*, is reached. It is thus that water is brought through cell membranes into living animal and vegetable tissues.

The theoretical importance of osmotic pressure, pointed out by van't Hoff, lies in the facts that its value increases with temperature and the entry of water against the pressure might be used to do work. Hence the laws of heat engines, already well known, may be applied to solutions. The following results thus obtained have been verified by experiment.

(1) The osmotic pressure of a dilute solution does not depend on the nature of the solute or solvent, but only on the number of solute particles in a given volume. This is true even in the extreme case where the solute can be dispersed without a solvent, i.e. as a gas. The osmotic pressure of a dilute solution, therefore, has the same value as the pressure an equal number of particles would exert as a gas in the same space.

(2) The freezing-point and vapour-pressure of a solution are less than those of the solvent if the ice and steam contain no solute, and relations exist between the osmotic pressure, the lowering of the vapour-pressure, and the depression of the freezing-point, so that any one of these quantities can be calculated from any other.

The gas value of the osmotic pressure is found to hold for solutions (e.g. of cane-sugar) which do not conduct electricity. Solutions of acids and salts give higher pressures. Arrhenius pointed out that the molecules of solute in these liquids must be dissociated, so that the number of pressure-producing particles is increased. This dissociation theory explains also the electrical properties of these same solutions. The number of parts or ions into which it is necessary to imagine a molecule dissociated in order to explain its electric conductivity is the same in dilute solution as the number needed to give its observed osmotic pressure. A salt like sodium chloride ($NaCl$), which must, if it dissociate, give two ions (Na and Cl), causes twice the osmotic pressure of cane-sugar, while sulphuric acid (H_2SO_4), which must yield three ions (H, H, and SO_4), produces nearly three times the normal pressure.

Some solutes diffuse through solvents and membranes much more freely than others, especially organic bodies, do. These less diffusible substances were called colloids by Graham. In the first kind of solution the dissolved particles are molecules, or their dissociated parts the electric ions. In colloids they consist of aggregates of molecules, ranging up to particles large enough to be seen in a microscope. The amount of dispersion a soluble solid will undergo in a liquid must be such that the available energy is a minimum. Sometimes this is only reached at molecular limits, but sometimes it stops sooner and a colloidal solution results. The particles in this case being larger, there are fewer of them, and so the osmotic pressure and the allied effects in colloid solutions are small, indeed usually negligible. The properties of ordinary solutions are those of mixtures of molecules, but colloid solutions are systems of two phases, and their properties depend chiefly on the surface tension between these two phases, the solute particles and the solvent.

Anything which affects the surface energy may change the state of aggregation. In extreme cases the particles can no longer remain dispersed, but collect together and are temporarily precipitated or permanently coagulated. This change may be produced by heat or sometimes by the action of salts or acids. In the latter case the effect is connected with the electrical properties, the presence of an electric charge altering the surface tension. Examples are seen in the deposition of the mud in rivers when they meet the salt of the sea, and in the clarifying effect of such salts as alum in many technical processes.

Owing to the difference in energy content, chemical reactions are not the same in surfaces of separation as they are in the bulk of a liquid, and need independent study. The most important constituents of soil and of living plants and animals are colloids, and thus colloidal chemistry is rapidly becoming of supreme importance in the investigation of agricultural and of physiological processes.—BIBLIOGRAPHY: W. C. D. Whetham, *A Treatise on the Theory of Solution, including the Phenomena of Electrolysis*; Sir James Walker, *Introduction to Physical Chemistry*; W. C. M'C. Lewis, *A System of Physical Chemistry*.

Solutrean Age. See *Palæolithic Age*.

Solvay, Ernest, Belgian chemist, was born in 1838, and died in 1922. During the European War he devoted his energies and fortune to the relief of the poor in Brussels.

His name is associated with the manufacture of sodium carbonate by the *Solvay* or *ammonia-soda* process, which is based on the fact that when a concentrated solution of common salt is saturated with ammonia, and carbon dioxide is passed through the mixture, sodium bicarbonate is precipitated, and ammonium chloride remains in solution: $NaCl + NH_4HCO_3 = NaHCO_3 + NH_4Cl$. To obtain the normal carbonate, the bicarbonate is calcined: $2NaHCO_3 = Na_2CO_3 + H_2O + CO_2$. The mother-liquor, containing ammonium chloride, is treated with lime obtained by burning limestone: $CaCO_3 = CaO + CO_2$; $2NH_4Cl + CaO = CaCl_2 + H_2O + 2NH_3$. The ammonia and carbon dioxide are recovered and used again.

Before Solvay's time the chief process for the conversion of sodium chloride into soda was the *Leblanc*, or *black-ash* process. Sodium chloride is warmed with sulphuric acid, and the mixture is then roasted. The reactions are $NaCl + H_2SO_4 = NaHSO_4 + HCl$; $NaHSO_4 + NaCl = Na_2SO_4 + HCl$. The solid product is sodium sulphate or *salt-cake*. This is heated with limestone and coal, forming *black ash*, from which sodium carbonate is extracted by lixiviation with warm water: $Na_2SO_4 + 2C = Na_2S + 2CO_2$; $Na_2S + CaCO_3 = CaS + Na_2CO_3$. The ammonia-soda process produces sodium carbonate in a pur state and more cheaply than the Leblanc pr cess, the output from which reached its max mum of 500,000 tons per annum about 188 Were it not for the recovery of by-products ar the large amount of capital invested, probabl the Leblanc process would by this time hav been obsolete. In 1918 the total production soda was nearly 8,000,000 tons, of which muc the greater part was made by the Solvay pr cess. See *Mond*.

Solway Firth, an arm of the Irish Sea, form ing part of the boundary between England an Scotland, and extending inland in a north-easter direction for above 41 miles, with a breadt diminishing from 20 miles, at its entrance be tween St. Bees Head, in Cumberland, and Bal carry Point, in Kirkcudbrightshire, to 7 mile and finally only to 2 miles. A large portion o the Solway is left dry at ebb-tide.

Solway Moss, a tract of mossland in th north of Cumberland, west of Longtown; th scene of a battle between the English and th Scots (under James V) in 1542, when the latte were defeated.

Solyman′, or **Suleiman II**, surnamed th *Magnificent*, Sultan of Turkey, born about 1495 died in 1566, was the only son of Selim I, whom he succeeded in 1520. Having put down a revol which occurred in Syria and Egypt, and concluded an armistice with Persia, he besieged and took Belgrade in 1521. The next year he captured th Island of Rhodes, which had been in the posses sion of the Knights of St. John for 212 years Turning his arms now against Hungary, he gained the battle of Mohács, and captured Buda and Pest. In 1529 he advanced on Vienna, but wa forced to raise the siege with great loss. Hi armies next gained considerable territories from Persia. In 1541 he overran a great part of Hun gary, but an armistice was concluded for fiv years in 1547, though war was renewed in 1551 In 1565 he attempted the capture of Malta in vain. Next year he died at the siege of Szigeth in Hungary.

Soma, a plant belonging to the nat. ord Asclepiadaceæ, the *Asclepias acida*; also an in toxicating drink obtained, it is supposed, from the plant, which the ancient Aryans believed wa pleasing to the gods as a sacrifice. They went so far in their adoration of soma that they per sonified it as one of their highest gods. In th Persian cult, *haoma*, the equivalent of the India *soma*, is both a god and the tree of life.—Cf. L. D Barnett, *Antiquities of India*.

Soma′liland, a region of East Africa, com prising the peninsula known as the 'Horn o Africa'. It derives its name from the Somalis the indigenous population, but is politically par titioned as follows:

	Sq. Miles.	Pop.
Great Britain	68,000	300,000
France	5,790	65,000
Italy	139,430	650,000
Abyssinia	130,000	300,000
Total	343,220	1,315,000

These figures are approximations from available estimates, but, in the absence of accurate census figures, all estimates must be considered as more or less vague guesswork.

Somaliland Protectorate (*British*).—This extends along the Gulf of Aden between Lahadu and Bandar Ziyada. Berbera (pop. 31,000) is the capital; other towns are Zeyla (7000) and Bulhar (7000). Skins and hides of fine quality, gums and resins, cattle and sheep are among exports; Indians and Arabs are the chief traders. The Indian rupee is the currency standard. In the interior the people (Mahommedans) are nomads, whose source of wealth lies in their cattle.

French Somaliland.—The colony lies between Eritrea and British Somaliland. Jibuti, a port created in 1888 (pop. 8400), is the seat of Government. There are some coastal fisheries, and enormous deposits of salt are worked (11,500 tons exported, 1918). A railway connects Addis Abbaba with Jibuti; and French Somaliland, the only division standing on the Suez Canal route, is the chief exit for Abyssinia. About 90 per cent of the total trade represents goods in transit.

Italian Somaliland.—A colony and protectorate extending along the Gulf of Aden and the Indian Ocean, bounded by British Somaliland, Abyssinia, and Kenya Colony. By a treaty with Britain, Italy acquired (1919) both banks of the Juba River, and the port of Kismayu (her only port, excepting a few open roadsteads). There is a special coinage of 1 rupee (15 rupees = £1 sterling), ½- and ¼-rupee pieces, and currency notes are issued. Agriculture is the chief business; durra, maize, gums, cotton, butter, and hides are exported. Camels and sheep are raised. Alula and Obbia are capitals of the sultanates of the Mijertins and Obbia respectively; the capital of the colony is Mogadishu (pop. 15,000).

Sombrerite, a natural variety of calcium phosphate found in some West Indian islands, and named from the Island of Sombrero. It is used as a fertilizer.

Somers, John, Lord, English lawyer and statesman, born in 1651, died in 1716. He took a prominent part in the opposition to the tyrannical measures of Charles II and James II. After filling many legal offices, he became Lord Chancellor in 1697. After the death of William III he withdrew into retirement, but was recalled by Anne, who made him President of the Council. He fell again with the Whigs in 1710. Science and letters found a warm patron in Lord Somers, who was one of the first to recognize Addison's ability.—Cf. H. Maddock, *An Account of the Life and Writings of Lord Chancellor Somers.*

Somerset, Robert Carr, Earl of, a favourite of James I, born in Scotland in 1589, died in 1645. He followed James to England when he succeeded Elizabeth in 1603. The king made him Treasurer of Scotland, and gave him a seat in the Upper House with the title of Viscount Rochester, and then of Earl of Somerset. In 1613 he married the wife of the young Earl of Essex (after her first marriage had been annulled), contrary to the advice of his friend, Sir Thomas Overbury. The countess never forgave Overbury for this; and on her suggestion he was sent to the Tower for some trivial offence, and after a few months dispatched by poison. Somerset was convicted of poisoning Overbury (q.v.), and was imprisoned in the Tower from 1616 to 1622. After his liberation he spent the rest of his days in obscurity and disgrace.

Somerset, a south-western county of England; area, 1613 sq. miles. The Mendip and Quantock Hills traverse the county; the Avon and the Parrett are the principal streams, but the county has a coast-line along the Bristol Channel. Cattle and sheep, cereals, and cider-apples are raised, and coal is found in the Mendips around Radstock. The county contains the cities of Bath and Wells, part of the city of Bristol, and the municipal boroughs of Bridgwater, Chard, Glastonbury, Taunton, Yeovil, and Weston-super-Mare. Taunton is the county town. Pop. (1921), 465,682.—BIBLIOGRAPHY: W. Page (editor), *Victoria History of the Counties of England, Somerset*; G. W. and J. H. Wade, *Somerset*; E. Hutton, *Highways and Byways in Somerset.*

Somerset House, a Government building in the Strand, London (situated between that thoroughfare and the Victoria Embankment), stands on the site of a palace commenced by the Protector Somerset, which, after being the residence of several royal personages, made way for the present buildings. It contains the offices of the registrar-general of births, deaths, and marriages, the exchequer and audit departments, the inland revenue, and the wills and probate registries of the High Court of Justice.

Somerville, Mary, Scottish writer on the physical sciences, born at Jedburgh in 1780, died at Naples in 1872. She was the daughter of Admiral Fairfax, and was to a great extent self-educated, but acquired a considerable knowledge of Greek and Latin. It was only, however, when she became acquainted with mathematics that she discovered the true bent of her genius, and in this study she made rapid progress. After her second marriage, to William Somerville, in 1812, she settled in London. At the request of Lord Brougham, and with the object of popularizing Laplace's *Mécanique Céleste* for the Society for the Diffusion of Useful Knowledge, she, in 1827, prepared her first work, *Mechanism of the Heavens*. It proved above the class for whom it was intended, and was published independently in 1831. This work, which brought her many honours, was followed by *The Connection of the Physical Sciences* (1834). She removed to Italy, where she wrote her *Physical Geography*, published in 1848, and *Molecular and Microscopic Science* (1869).

Somerville, a city of Massachusetts, United States, in Middlesex county, on the Mystic River. It is a semi-industrial city about 2 miles from Boston. Pop. (1920), 93,000.

Somme, a department of France; area, 2379 sq. miles. It is drained by the Somme, and is one of the least picturesque districts of France. Cider and poultry are notable products. The manufactures, especially textiles, are very important. The capital is Amiens. Pop. 453,000.

Somme, a river of France, which rises in the department of Aisne, 7 miles north-east of St. Quentin; flows south-west into the department of the Somme, and falls into the English Channel about 15 miles beyond Abbeville; length, 150 miles.

Somme, Battles of the. See *European War.*

Somnam'bulism, a peculiar perversion of the mental functions during sleep, in which the subject acts automatically. The organs of sense remain torpid and the intellectual powers are blunted. During this condition some instinctive excitation may take place, and there may be the production of impulses, in consequence, of different kinds. Walking in sleep is the most palpable, but not the most marvellous characteristic of this condition. The person affected may perform many voluntary actions implying to all appearance a certain degree of perception of the presence of external objects. The somnambulist gets out of bed, often dresses himself, goes out of doors, and walks frequently over very dangerous places in safety. On awaking in the morning he is either utterly unconscious of having stirred during the night, or remembers it as a mere dream. Sometimes the transactions of the somnambulist are carried much further; he will mount his horse and ride, or go to his usual occupation. In some cases somnambulists are capable of holding conversation. Somnambulism occurs in the sensitive and excitable, often in conjunction with other nervous affections, and is hereditary. Artificial somnambulism is induced by hypnotism, and the consciousness is for the time entirely absorbed by one set of ideas.

Sona'ta, a word derived from the Italian verb *sonare*, to sound, used to indicate music for instruments in contradistinction to vocal music, or *cantatas*. In its musical application the term came first into use early in the seventeenth century, when the art of writing for instruments began to receive serious attention, and it was applied to any piece of instrumental music, irrespective of its form. Thus there was the *sonata da camera*, or piece of chamber-music, and the *sonata da chiesa*, or piece of music to be played in a church. In course of time the meaning was restricted to movements of a certain formal type, which demanded as indispensable features two chief themes. The quickly growing sense of key-relationship required almost from the first that the two chief themes should be in contrasted keys, and from this elementary principle the great achievement of modern sonata-form has been directly developed. Scarlatti and C. P. E. Bach were chief among the early writers of sonatas; Haydn definitely established the principles of sonata structure; Mozart added to its poetic significance; and Beethoven brought it to perfection. The general plan of a movement in sonata-form is as follows: first theme—bridge—second theme in a related key—codetta—development of themes—first theme—bridge (altered)—second theme (in same key as first theme)—an extended coda, or musical peroration. In every sonata one at least of its three or four movements should be written according to this plan.

Son'drio, a province and town of Lombardy North Italy. The province borders on the Grisons and Tyrol, and comprises the valley of the Adda and spurs of the Rhætian and Bergamesque Alps. The town is the provincia capital and stands on the Mallero. It is a tourist centre. Area, 1257 sq. miles; pop (province), 135,133; pop. (town), 10,000.

Song. The art of song-writing is practised both by poets and musicians, and in both cases a purely lyrical form of expression is implied with a single clearly defined mood or idea a subject matter. The songs of Burns are perfec examples of this form, and are still songs even when rendered without music; but in the genera mind, music is an essential element of song Under *Folk-music* the origin of folk-song ha already been discussed, and under *Music* th development from folk-song to the art-song ha briefly been traced. To Beethoven belongs th credit of having taken the first decided step towards that intimate union of an equally important voice and piano which is the modern art-song. He showed that the accompanimen could by judicious alteration be made to reflec the changing moods of a poem, even when th different verses were all sung to the same melody In the long list of succeeding song-writers fou names stand out as the greatest that have ye appeared in the history of music. These ar

Schubert, Schumann, Brahms, and Hugo Wolf, a remarkable succession of inspired writers, each of whom left the art-song a more intimate union of words, melody, and accompaniment than he had found it.

Songuldak, or **Zunguldak**, a Turkish Black Sea port, one of the ports of the Heraclea (Eregli) coal-basin. It has an up-to-date breakwater-protected harbour, with warehouses and coal-screening plant, and is the terminus of a light railway from the coal-fields.

The Heraclea coal-basin is the most important in Turkey, and before the European War it was operated by a French company, who built the port of Songuldak; but Belgian and German interests were also represented. Other ports of the region are Eregli (Heraclea), and Koslu Bay, about 2 miles west of Songuldak.

Sonics, the name given to the transmission of energy by wave-motion, which was first suggested by George Constantinesco in 1914 for the purpose of controlling the actuation of a machine-gun to fire between the blades of the running propellers of aeroplanes. Messrs W. H. Dorman & Co., of Stafford, have developed the use of the principle in its application to such mining tools as rock-drills, and to the riveting and caulking tools used in shipbuilding.

A small piston in a cylinder is used to create the wave-motion in water, and the waves produced are passed through pipes to a similar cylinder at the other end of the system. The whole plant is filled with water. The water does not move forward as a rigid body, but compression-waves are transmitted through it. These waves move with the velocity of sound in water. The tools used must be capable of working in synchronism with the movements of the piston in creating the waves, otherwise the plant would not operate successfully.

Sonneberg (zon′ne-ber*h*), a town of Germany, in the Republic of Thuringia, formerly in the Duchy of Saxe-Meiningen, on the Röthen. Toys, chiefly dolls, of wood or papier mâché are made. Pop. 16,000.

Sonneratia, a genus of Indo-Malayan shrubs and small trees, order Lythraceæ, growing in mangrove-swamps. *S. acida* has numerous large breathing-roots.

Sonnet, a piece of verse (properly expressive of one main idea) consisting of fourteen decasyllabic lines, with rhymes arranged according to one or other of certain definite schemes. The name was at first given to any short poem of a lyrical or amatory character, but was soon restricted to a definite form of poem. Thus as early as 1575 Gascoigne in his *Posies* says: "Some thinke that all Poemes (being short) may be called Sonets. . . . I can beste allowe to call those Sonets whiche are of fourtene lynes, every line conteyning tenne syllables." Shakespeare, however, uses the word 'sonnet' in its unrestricted sense (e.g. *Twelfth Night*, iii, 4, 24).

There are two types of sonnet in English, the Shakespearean, consisting of three quatrains clinched by a couplet (seven rhymes in all), and the Petrarchan, a more exacting form (five rhymes in all). The Petrarchan consists of two parts, the octave and the sestet (eight lines and six lines), and it is an essential feature of this form that there should be a break at the end of the octave. Milton failed to observe this rule, thus leaving a blemish upon sonnets which are otherwise perfect. The rule for the rhymes in the octave is very strict; they must be a, b, b, a, a, b, b, a, no other form being permissible. More liberty is allowed in the sestet, which has three rhymes. It is permissible but not desirable to end the sestet with a couplet. Some critics who should know better blame Shakespeare for writing sonnets of the Shakespearean type, as if it were a mere indolence on his part not to choose the more rigorous form. The Shakespearean form of sonnet is excellent for its purpose, and has been written by Drayton, Keats, and Hartley Coleridge. Three quatrains and a couplet is an ideal length, two being too short and four too long. The Petrarchan sonnet has been written badly by innumerable writers. Its chief exponents are Drummond of Hawthornden, Milton, Wordsworth, Mrs. Browning, and Rossetti. All the best writers of the sonnet adhere most faithfully to the rules. The sonnet is usually didactic rather than purely lyric, but the didactic element is subordinated to the poetic. Those 'who have felt the weight of too much liberty' find the rigour of the game of sonnet-writing immensely beneficial to their work, as the sonnet-form counteracts all tendency to prolixity. Some poets, however, agree with Ben Jonson, who "cursed Petrarch for redacting verses to Sonnets, which he said were like that Tirrants bed, wher some who were too short were racked, others too long cut short".

As an example of a perfect sonnet may be quoted that of Joseph Blanco White (1775–1841), who illustrated the proverb of his native country, Spain, that "he is a fool who cannot make one Sonnet, and he is mad who makes two".

TO NIGHT

Mysterious Night! when our first parent knew
Thee from report divine, and heard thy name,
Did he not tremble for this lovely frame,
This glorious canopy of light and blue?
Yet 'neath the curtain of translucent dew,
Bathed in the rays of the great setting flame,
Hesperus with the host of heaven came,
And lo! creation widened on man's view.
Who could have thought such darkness lay concealed
Within thy beams, O Sun! or who could find,
While fly, and leaf, and insect stood revealed,
That to such countless orbs thou mad'st us blind:
Why do we, then, shun Death with anxious strife?—
If Light can thus deceive, wherefore not Life?

BIBLIOGRAPHY: Sir Sidney Lee, *Elizabethan Sonnets*; Sir Hall Caine, *Sonnets of Three Centuries*; William Sharp, *Sonnets of this* (i.e. the nineteenth) *Century*.

Sonnino, Sidney, Baron, Italian statesman, financier, and scholar, born 1847, died 1922. He entered Parliament in 1880, and was Premier in 1906 and 1909–10. During the European War he was Italian Foreign Minister (1914–9), and was an Italian delegate to the Versailles Peace Conference. On the fall of Orlando (19th June, 1919) he did not seek re-election, and was made a Senator. He was a noted Dante scholar.

Sonom'eter, or **Monochord,** an apparatus used for studying the transverse vibrations of stretched wires or strings. It consists of a long wooden box on which the wire is stretched. In one form weights are used to stretch the wire, and the latter is carried over a pulley to a weight-pan, or the sonometer is placed in a vertical position. In another, the tension of the wire is read from a spring balance, and a small non-slipping winch is employed to apply the tension. By means of movable bridges the length of vibrating wire may be varied. The apparatus can be used to determine the frequency n of the note given by the wire, since a wire of length l cm. under tension T dynes and weighing m_1 gm. per centimetre vibrates with frequency $n = \sqrt{T/m_1} \div 2l$.

Sono'ra, a maritime state of Mexico, lying along the Gulf of California. It abounds in mineral wealth, including gold, silver, copper, and coal. Cereals, tobacco, and sugar-cane are raised. Hermosillo is the capital, and Guaymas the principal port. Area, 76,000 sq. miles; pop. 265,000.

Sonsona'te, a town of San Salvador, Central America, connected by rail with Acajutla. Pop. 15,000.

Soodras (*Sûdras*), the lowest of the four great castes of India—Brahmans, Kshatriyas, Vaisyas, Soodras. They are chiefly farmers, gardeners, artisans, and labourers of every kind.

Sooran'jee, or **Morindin,** a drug used for dyeing, prepared from the root of the *Morinda citrifolia*.

Soosoo, or **Susu,** a cetaceous mammal, the *Platanista gangetica*, which resembles the dolphin in form, and attains the length of about 12 feet. It inhabits the Ganges; is most abundant in the sluggish waters of its delta, but is found also as far up the river as it is navigable. It is closely allied to freshwater dolphins of the South American rivers.

Soot, a black substance formed when almost any form of fuel is burnt with incomplete combustion. It consists of fine black particles of carbon and carbon compounds, and is deposited on the sides of the chimney or pipe conveying the smoke. The soot of coal and of wood differ materially in composition, the former containing more carbonaceous matter than the latter. Coal-soot contains ammonium chloride and sulphate, and has been used for the preparation of the carbonate. It contains likewise an empyreumatic oil; but its chief basis is charcoal, in a state in which it is capable of being rendered soluble by the action of oxygen and moisture; on account of this action and that of the ammoniacal salts, it is used as a manure, and acts very powerfully as such. The soot of wood has been minutely analysed, and found to consist of fifteen different substances, of which ulmin, nitrogenous matter, calcium carbonate, water, calcium acetate and sulphate, potassium acetate, and carbonaceous matter insoluble in alkalis are the principal.

Sophists, a school of philosophers who appeared in Greece about the middle of the fifth century B.C. The Sophists occupy the transition period between the elder cosmical philosophies of Greece and the subsequent systems, beginning with Socrates, Plato, and Aristotle, which were founded primarily on the study of the human mind. The direct services of the Sophists to philosophy appear to have been small and negative; but they rendered great services to science and literature, and thus indirectly to philosophy. They have been not inaptly compared to the French Encyclopédistes. They belonged to all the liberal professions, and taught all the usual branches of knowledge. Some of them were distinguished as rhetoricians and grammarians, others as men of science. They frequently made a profession of universal knowledge, and though they carried their pretension so far as to profess to speak of subjects of which they knew nothing, all their pretensions were not equally frivolous. Rhetoric, to which the Sophists gave undue importance, was systematically studied by them, and they supplied some of the earliest models of good Greek prose.

Protagoras of Abdera, the earliest and one of the most important of the Sophists, was contemporary with Socrates, but considerably older; he applied the Heraclitean doctrine of the universal flux of all things to the mind, and maintained the uncertainty of the existence of the gods and the relativity of all truth. "Man", he said, "is the measure of all things. All opinions are equally true, and contradictories may be affirmed with equal authority." Protagoras is said to have been the first who taught for pay, and, though he left his pupils to fix his remuneration according to the amount of benefit they had received, he is said to have become wealthy. Gorgias of Leontini, who came to Athens in 427 B.C., took a bolder stand in scepticism than Protagoras. His book was called

Of the Non-existent or of Nature; and his three cardinal propositions were that nothing exists, that if anything exists it cannot be known, that if it could be known it could not be communicated. Other Sophists were Hippias, Thrasymachus, Critias, and Prodicus. Hippias of Elis represented the law as a tyrant in compelling men to act contrary to nature. Thrasymachus made the gratification of desire the natural right of the stronger, and might the law of nature. Critias, one of the thirty tyrants, ascribed faith in the gods to the invention of politicians. Prodicus of Ceos taught a morality more in accordance with ordinary conceptions of right. His teaching was recommended by Socrates, and he has sometimes been called his predecessor. —BIBLIOGRAPHY: T. Gomperz, *Greek Thinkers*; J. Burnet, *Greek Philosophy*.

Sophocles, the second of the three great Greek writers of tragedies, was born about 495 B.C., and died in 406 B.C. He was thirty years younger than Æschylus and fifteen years older than Euripides. His father was Sophillus, and his native place was Colonus, a suburb of Athens. The beauty of his body when young was no less remarkable than the beauty of his mind when mature, and at the age of fifteen he was chosen to lead the chorus of boys in the celebration of the victory of Salamis. He excelled both in scholarship and in games. At the age of twenty-seven he competed against Æschylus with a tragedy (? the *Triptolemus*) and won a victory. A legend (not well founded) says that the judges on this occasion were Cimon and the other generals, who had just returned from Scyros. The younger generation had knocked at the door successfully; in his magnificent *Oresteia*, produced some ten years later, Æschylus showed distinct traces of the influence of Sophocles. One of the few facts which we know about Sophocles is that in the Samian War of 440 B.C. he was one of the generals who served with Pericles. It was typical of him to take his full share in all civic duties. He is said to have owed his appointment to the political wisdom displayed in his *Antigone*, which was produced in 440 B.C. One of the other stories about Sophocles was that in his extreme old age he was indicted by his son Iophon and accused of being incapable of managing his own affairs. His sole defence was to recite a chorus out of the newly written *Œdipus Coloneus*; the case was dismissed. All the other legends about him are more or less unimportant, but all go to show that he was of a gentle disposition, and well beloved by everyone.

The minor poems, elegies, and pæans written by Sophocles are all lost, and of his 113 dramas (some of which were, of course, satyr-plays) only seven tragedies and some fragments survive. The seven extant tragedies, in the probable order of their production, are: *Ajax*, *Antigone*, *Electra*, *Œdipus Tyrannus*, *Trachiniæ*, *Œdipus Coloneus*, and *Philoctetes*. The *Ajax* is a powerful play, dealing with the madness and suicide of the hero, who, like Don Quixote, attacked a flock of sheep, thinking it was a band of warriors. The latter part of the play is concerned with the question of the disposal of the body of Ajax. The *Antigone*, which may be earlier than the *Ajax*, is one of the most famous of Greek tragedies. Its story, which centres upon the conflicting claims of State and of family, makes an appeal to all readers. Its heroine, the virgin-martyr, is the greatest of the women in the seven plays, albeit she is somewhat cold, resembling in this respect Isabella in *Measure for Measure*. The *Electra* is a hard and brilliant play, deriving most of its hardness from its heroine. It suffers much from the inevitable comparison with the *Choephori* of Æschylus. It is a play which arouses admiration rather than enthusiasm. The *Œdipus Tyrannus* is universally recognized as the masterpiece of Greek tragedy. It is to tragedy what the *Doryphorus* of Polyclitus was to the art of statuary —a canon or standard of perfect proportions. In some ways it resembles a play of Ibsen (e.g. *Rosmersholm*), as the plot does not consist of what the characters do, but of their finding out what they already have done. This play contains the greatest examples of Sophocles's irony. The *Trachiniæ* is perhaps the least memorable of the extant plays, but the character of Deianira is one of the most beautiful of non-Shakespearean women. The *Œdipus Coloneus* is a marvellously poetical play, written in a mood akin to that of Shakespeare when he wrote *The Tempest*. It has little plot, but quite enough to sustain the interest. Œdipus himself is a wonderful portrait of old age, drawn by a man who was himself nearly fourscore and ten years old. When Shakespeare wrote *King Lear* he was only forty-one. In the *Philoctetes* there is a certain lessening of the tragic tension, and a catastrophe is averted by the intervention of Heracles. This play is extraordinarily fresh to be the work of a man of eighty-seven. The characters are vividly drawn, and there is a striking contrast between the marooned Philoctetes, Odysseus the man of the world, and Neoptolemus the ingenuous youth.

Sophocles introduced certain improvements in his plays. He was the first playwright to employ a third actor. It is probable that in writing certain parts he had certain actors in view. He introduced painted scenery. In his management of the chorus he is extremely skilful, being in this as in many respects the mean between

Æschylus and Euripides. His choruses do not take up too much of the play, nor are they entirely unconnected with the dramatic situation, as those of the later poets frequently are (Aristotle, *Poetics*, xviii). His most striking reform, however, is his breaking up of the trilogy. He exhibited his plays in sets of three, but each member of the set was an independent entity. It is incorrect but not uncommon to call the *Œdipus Tyrannus*, *Œdipus Coloneus*, and *Antigone* a trilogy. Many years elapsed between the writing of these plays, and the *Antigone* is by far the earliest of the three. Æsthetically they may be considered a trilogy, but actually they are not.

In considering the plays of Sophocles, it should always be remembered that the seven which we possess are all masterpieces of mature style, probably selected for educational purposes. Sophocles when he produced the earliest of his extant plays was some three years older than Shakespeare ever was. So we do not possess any of his work that is immature or unsatisfactory, nothing corresponding to *The Two Gentlemen of Verona* or *Troilus and Cressida*. The *Antigone* was Sophocles's thirty-second play, according to some authorities. These facts help to account for the perfection of the extant plays, a perfection which is perfectly satisfying to some scholars, while it appears a blemish to others. Sophocles is so much an incarnation of the Greek spirit that he appeals most strongly to scholars; to some untrained readers he appears faultily faultless, a mere model for juvenile writers of Greek iambics. In the *Poetics* (xvii) Aristotle says that poetry implies either a happy gift of nature or a strain of madness. In the one case, a man can take the mould of any character; in the other, he is lifted out of his proper self. There is no doubt that Sophocles is a poet with a happy gift of nature, one who can take the mould of any character. Of this kind of poet he is perhaps the greatest. Those with a strain of madness may be, however, loftier poets, and their work may be greater though less equable. Sophocles excelled in self-control; he was a good critic both of his own and of other men's work. Thus he said that Æschylus did the right thing without knowing it, and that he himself drew men as they ought to be drawn, while Euripides drew them as they were. These remarks imply a self-conscious attitude towards his art. The excellence of Sophocles is, however, very great. He has the art of concentration, compressing much into a few lines. His plays are full of variety; he had no set formula for a play. In every play he shows the even balance of his mind. His art is so unobtrusive that it conceals its own artfulness; he works like nature, and like nature he does nothing in vain. His smallest touches are fraught with meaning. His plots are masterpieces of construction; his mastery over the iambic senarius is complete, and his lyrics are among the greatest of Greek poems. —Bibliography: Sir R. C. Jebb, *Sophocles* (a most elaborate edition of the plays with a prose translation); L. Campbell, *Sophocles* (verse translation); J. S. Phillimore, *Sophocles* (three plays, *Œdipus Tyrannus*, *Œdipus Coloneus*, *Antigone*, translated); C. W. Collins, *Sophocles* (Ancient Classics for English Readers Series).

Sopho′ra, a genus of plants, nat. ord. Leguminosæ. The species are ornamental shrubs and trees, found chiefly in central and tropical Asia, and the tropical and sub-tropical parts of South America. They have pinnate leaves, and terminal racemes or panicles of whitish flowers. The species best known in England are *S. japonica* and *S. chinensis*.

Sophron, Greek writer of mimes, flourished at Syracuse about 430 B.C. His mimes, which were prose dialogues, are lost; but some idea of their nature may be gained from the 2nd and 15th Idylls of Theocritus (q.v.), and from the mimes of Herodas (q.v.). Sophron powerfully influenced Plato in the composition of his *Dialogues*.

Sopra′no, the highest register of female voices. Its ordinary range is from C below the treble staff to A above it, though some sopranos may go as high as E. The mezzo-soprano register is from A to F, that is, a third lower than the soprano.

Sora′ta, or **Illampu**, one of the highest of the Andes, a volcanic cone in Bolivia, on the east side of Lake Titicaca. 21,484 feet altitude.

Sorau (zō′rou), a town of Prussia, in the province of Brandenburg. Manufactures include woollen and linen cloth, dyes, shoes, glass, and machinery. Pop. 18,000.

Sorbonne′, a celebrated French institution founded in 1252 by Robert de Sorbon, chaplain and confessor of Louis IX. The college was designed by its founder as a sort of hostel for poor students of the university, and for the benefit and accommodation of certain secular priests devoted to the study and gratuitous teaching of theology. It was thus originally a theological society, whose axiom was: " Omnes nos sumus socii et æquales ", and it soon became known in Christendom as the community of poor masters. The characteristics of the society were equality and poverty. Enjoying as it did the favour of the Holy See and royal patronage, the Sorbonne soon became an authority in matters theological, and was for centuries synonymous with anti-liberal tendencies in the Church. On the other hand, the Sorbonne introduced in 1470 the art of printing into France, by calling to Paris Gering, Friburger, and Crantz, three associates of Gutenberg. It also condemned the Jesuits and took sides with the Jansenists. Cardinal Richelieu erected a new building for the Sorbonne in 1629, and as a benefactor he was buried in the church of the Sorbonne, where his tomb is still preserved. Suppressed by the Revolution, and deprived of its endowments on 5th April, 1792, it was restored by Napoleon in 1808, at the reconstruction of the university, as the theological faculty. The construction of the present building, begun in 1884, was completed in 1889; since 1896 the Sorbonne has been the University of Paris, and houses the faculties of letters and science, and various other departments known as the École des Hautes Études.

Sorel′, a town and river port of Canada, in the province of Quebec, on Lake St. Peter, at the mouth of the Richelieu. Industries include shipbuilding, founding, clothing, aerated waters, pulp-milling, and agricultural implement making. Pop. 8000.

Sore Throat is due to inflammation or irritation of the region from the back of the mouth to the larynx, but it is most frequently associated with infection of the tonsils or the region around them. There may be either acute or chronic tonsillitis, and where the tonsils are enlarged or unhealthy the person is much more subject to these attacks. In certain cases the infection spreads to the parts around, and forms an abscess in the throat wall called a quinsy. This condition is associated with much pain and discomfort. Sore throat may also be a symptom in some general diseases, and in some of these the throat is the site of the infection. Thus it is prominent in diphtheria, scarlet fever, and in the secondary stage of syphilis, while there is a definite connection between sore throat (tonsillitis) and rheumatism. Infections of the tonsils, causing sore throat, are predisposed by decayed teeth, septic gums, a general unhealthy condition of the mouth, and by chronic nasal catarrh.

Sorghum, a genus of grasses, some species of which are known by the general name of millet. They are tall grasses with succulent stems, and are found in the tropical parts of Asia, whence they have spread to other warm regions. *S. vulgāre* is the largest of the small cereal grains, and is called Guinea-corn and Indian millet. The different kinds are called jowar in India, where many of the inhabitants live upon these small dry grains, as upon rice. It is the dhurra and Kaffir corn of Africa. Sorghum has been introduced into the south of Europe, where it is chiefly used for feeding cattle and poultry, but it is also made into cakes.

So′ria, a province of North-Eastern Spain; area, 3983 sq. miles; pop. 158,000. Soria, on the Douro, and on a plateau over 3400 feet altitude, is the capital. Pop. 8000.

Sorrel (*Rumex acetosa*), a plant belonging to the nat. ord. Polygonaceæ. The leaves have an acid taste, and have long been used in salads. The stems are upright, 1½ or 2 feet high, provided with a few arrow-shaped leaves on the inferior part of the stem, and lanceolate ones above. The sheep's sorrel (*R. acetosella*) is smaller than the preceding, but resembles it in habit. Wood-sorrel is of the genus Oxălis.

Sorrel Tree (*Oxydendrum arboreum*), a tree belonging to the nat. ord. Ericaceæ. It inhabits the range of the Alleghanies from Virginia to Georgia. The leaves are 4 or 5 inches long, oval-acuminate, finely toothed, and strongly acid in taste. The flowers are small, white, and disposed in long one-sided racemes, clustered in an open panicle.

Souari-nut (sö-ä′rē), the fruit of *Caryocar nucifĕrum*, a native of British Guiana. It is spherical in form, of a reddish-brown colour, and measures 5 to 6 inches in diameter. It contains four or fewer seeds embedded in a white pulp. They contain a nutty, oily kernel, which is pleasant to eat, and is imported into Britain under the name of butter-nuts (q.v.).

Soul, the rational and spiritual part of man which distinguishes him from the brutes; the indwelling spirit which is both immaterial and immortal. The belief in an animating principle as distinguished from the body has existed since time immemorial. It is a belief which has found acceptance among all peoples, and philologists have proved that there is hardly a language wherein the word soul or its equivalent is not to be found. The mysteries of life and death suggested to the human mind the belief in an invisible spirit which gave life and movement to all living things. The ancient Egyptians developed definite ideas about the existence of the soul, but connected its life with the preservation of the body. In Indian philosophy the soul is considered as the principle of life; it is distinguished from the body, which is only a transitory episode in the life of the former. In the Old Testament the reality of the soul, as distinct from the body, is never asserted. Among the Greeks, Homer distinguishes between soul and body, but the soul, when separated from the body, has only a shadowy existence. Plato taught that the soul is immaterial and immortal. He defined the soul as self-moving activity, and as consisting of three parts, the rational soul alone being immortal. Aristotle defined the soul as the entelechy of the body, that is, the actual as opposed to the potential existence. The Stoics, who held all things real to be material, considered the soul as an emanation of the deity, and consisting of the warm breath within us. Origen, like Plato, ascribed pre-existence to the soul. Augustine maintained that the soul, which is immaterial, was present in the entire body and in every part of it. Christianity recognized body and soul as a dualism. In modern philosophy the dualistic theory was especially elaborated by Descartes. He conceived the soul as the thinking substance, as distinguished from the body, which is extended substance, both being separate realities. The seat of the soul, according to Descartes, is the brain, and specifically the pineal gland. The interaction between body and soul is only possible through divine assistance. To avoid the dualism of Descartes, as well as the pantheism of Spinoza (q.v.), Leibnitz defined the soul as a monad, i.e. a simple unextended substance, with the power of acting. In his theory of Pre-established Harmony he excludes intercausal relations between body and soul. Hume denied the existence of the soul as a real or permanent subject, whilst modern psychologists look upon the soul as the inner activity of which we are conscious. W. James defines it as "the permanent substance or agent, whose act is the state of individual consciousness". See *Metaphysics*; *Mind*; *Monism*; *Psychology*.

Soult, Nicolas Jean de Dieu, Duc de Dalmatia and Marshal of France, born at Saint Amans la Bastide, in the department of Tarn, 1769, died 1851. In 1785 he enlisted in an infantry regiment, and, raised from the ranks, he became successively lieutenant and captain in his regiment, and after successive promotions was named general of division by Masséna, to whose army he was attached. He was one of the marshals created immediately after the formation of the Empire in 1804; and in the Austrian War in 1805 distinguished himself at Ulm and Austerlitz. He acquired new fame in the Prussian campaign; and in 1807, after the battle of Friedland, took Königsberg. From 1808 to 1812 he fought in Spain, but, overmatched by Wellington, was unable to gain many laurels. In 1813 he was recalled, in consequence of Napoleon's disasters, to take the command of the 4th corps of the grand army, and commanded the infantry of the guard at Lützen. On the news of Wellington's victory at Vittoria he was sent back to reorganize the French force in Spain, and did his utmost to oppose Wellington's triumphant career till Napoleon's abdication. Soult then became an adherent of Louis XVIII, but on Napoleon's return he joined his standard, and after the second restoration he took up his residence at Düsseldorf. He was permitted to return to France in 1819, and in 1827 was raised to the peerage. After the July revolution of 1830, and on two subsequent occasions, he held ministerial office, and in 1846, on retiring from public life, was created Grand-Marshal of France.—Cf. A. Sallé, *Vie politique du maréchal Soult.*

Sound, a term applied both to the external disturbance which stimulates our sense of hearing and to what is heard. In the perception of sound, three things are requisite, namely, a sounding body, a medium through which the disturbance travels, and the ear by which the sound is heard. Sounds may be discriminated as being either musical sounds or noise, and experiment shows that any regular periodic motion or vibration will, if rapid enough, give rise to a musical sound. The rotation of a circular saw or the sounding of a siren may be cited as instances in which periodic noises originate definite musical tones. The number of teeth which pass a given point in one second, i.e. the number of repetitions of the periodic motion which take place in one second is called the frequency of the vibration. As the speed of the saw diminishes, the note which it emits is heard to fall in pitch. Hence it may be noted that pitch depends on the frequency of the sounding body. In order that the saw may make a musical sound (apart from the noise inevitably associated with the sound) it is necessary that the vibrations should be sufficiently rapid. Below a certain speed the noise of the separate teeth may be distinguished, and above this speed a very low hum is heard. This brings out a limitation of the human ear, which is capable of perceiving sounds only within certain limits of frequency; these may be set at 30 for the lower limit and about 24,000 for the upper limit of audibility, but these limits vary from one person to another and in the same person with age.

Sound travels at a definite speed which is slower than that of light, since in nature the thunder is heard after the lightning flash has passed. The medium of transmission of sound is, in general, the air, but all kinds of matter transmit sound; sound does not pass through a vacuum. Sound is transmitted through the medium by means of a wave motion of the particles of the medium. In the case of a tuning-fork vibrating in air, the air is alternately compressed and rarefied by the action of the prongs, and the waves which are sent out consist of a series of alternate compressions and rarefactions, which may be regarded as corresponding roughly to the crests and hollows of water waves. Within a sound-wave the particles of the medium vibrate to and fro along the line of propagation of the sound. The vibrations are hence called longitudinal; they have a certain amplitude or maximum displacement of the particle from its rest position; their frequency is that of the sounding body; and their wave-length is the shortest distance between two particles in the same state of displacement and motion. We may convince ourselves that the vibrations in sound-waves are longitudinal by considering that the drum of the ear requires direct or normal impact to set it in vibration. Musical sounds may differ from one another in loudness, pitch, and quality; loudness depends on the amplitude of the vibration, pitch on its frequency, and quality on the admixture of harmonics or overtones. By quality is meant that property of a sound by means of which the ear instinctively differentiates it from other sounds of the same pitch and loudness; for example, flute, stringed instrument, and human voice can be recognized and separated by their differences in quality.

Speed of Sound in Air.—Since the experiments of the Florentine Academy many determinations of the speed of sound have been made by timing the interval between the flash of a cannon and its report. These show that sound travels at about 331 metres per second, or 1087 feet per second at 0° C. Experiment and theory show that the speed varies with the temperature, but not with the pressure of the air. The measurements made by Regnault and others tend to show, however, that the speed diminishes with the intensity of the vibration. The speed of sound increases by 2 feet per second for each degree C. rise in temperature. The speed of sound may be shown to depend on the physical properties of the medium through which it travels. If E is the elastic modulus brought into play by the vibrations, and d is the density of the medium, V, the speed of sound, is given by $\sqrt{E/d}$. For air it can be proved that the speed is $\sqrt{P\gamma/d}$, where P is the pressure and γ the ratio of the two specific heats of air (see *Specific Heat*). The speed V is related to the frequency n and the wave-length λ by the equation $V = n\lambda$.

Reflection of Sound.—Sound-waves conform to the ordinary laws of reflection. This has been proved by photographing the waves. The reflection of sound accounts for the inferior acoustical properties of many halls and large rooms, the existence of echoes in general, the property of the whispering gallery in St. Paul's Cathedral, and the use of the speaking-tube as a means to transmit speech.

Refraction of Sound.—Acoustic prisms and lenses have been employed to verify the change in the direction of sound-waves on passing into another medium. Refraction takes place in the atmosphere as a consequence of wind-speed variation or temperature variation with height above the ground. Either of these may cause a change in the speed of the waves with level. Thus, sound-waves moving with the wind are refracted downwards, but the opposite takes place with motion of the waves against the wind. If the temperature increases with height above the ground, the waves are again refracted downwards, and tend to travel to a greater distance. This condition may be frequently observed about sunset. But when with increase in height there is fall of temperature, the sound-waves are refracted upwards, and the sound does not carry well—a condition often noticeable on a hot summer day.

Interference of Sound-waves.—When two trains of waves arrive simultaneously at the ear, the effect heard depends on the relative frequencies of the two waves. If the two sounds have the same wave-length, they may be capable of combining to produce silence; but when there is a difference in the wave-lengths, beats are heard, the number of beats heard per second being equal to the difference of the two frequencies.

Measurement of Frequency.—The number of vibrations made in one second by a sounding body may be determined to within 1 or 2 per cent by means of the siren or the sonometer (q.v.). The latter instrument can be employed over a range of about 90 to 1200 vibrations per second, i.e. the range of pitch of ordinary music. Accurate methods which have been employed to determine fork frequencies comprise Scheibler's tonometer, Mayer's graphic method, M'Leod and Clarke's method, and those in which combined use is made of the oscillograph and the kinematograph. Scheibler's method depends on the production of beats; it consists of a series of tuning-forks so adjusted that each fork gives four beats per second when sounded with either of the neighbouring forks. In one of Scheibler's instruments there were fifty-six forks giving a range of frequencies of one octave, viz. from 220 to 440. After trial had shown that the frequency of the test note lay between two standard forks, the true frequency was determined by timing the beats which the note made when sounded successively with each of the standards.

Sound Detection.—During the European War the necessity to locate enemy guns brought into existence a 'sound-ranging' section. Listening devices were placed in different surveyed positions; these passed on their indications to a central station where they were recorded automatically on a photographic film moving at a known rate, and the distance and direction of the gun were calculated from the recorded times of arrival of the sound at three different stations. The device employed was termed a microphone. The hot-wire microphone of Tucker and Paris consists of a wire grid placed in the mouth of a resonator; the wire carries a current which causes it to glow feebly, and when resonance takes place the motion of the air in the mouth of the resonator cools the grid; this lowers the electrical resistance of the grid, disturbs the electrical balance of the circuit, and causes the deflection of a galvanometer. In the case of the arrival of a gun report, the grid was noticed to 'blink'. The apparatus is capable of many applications to sound problems. See *Echo*; *Microphone*; *Reflection*; *Refraction*; *Resonance*; *Sensitive Flames*; *Singing Flames*; *Siren*; *Sonometer*.

Sound, The, a strait which connects the Kattegat with the Baltic, and separates the Danish Island of Zealand from Sweden. It is 66 miles long, and roughly 17 miles broad. The name Sound, however, is more properly applied to the narrow passage, 3 miles wide, between Elsinore and Helsingborg. Formerly all merchant vessels passing the Sound had to pay duty to Denmark at Elsinore, but in 1857 the duties were abolished by treaty, Great Britain paying one-third of the indemnity. During the European War a part of the Sound (Kogrundsrännan) was closed by the Swedish Government to all but certain Swedish vessels, on account of the danger involved to Swedish neutrality by attempts of belligerents to seize vessels passing through.

Sounding. See *Lead-line*; *Deep-sea Exploration*.

Sourabaya, or **Surabaya** (sō-rȧ-bä′yȧ), a seaport-city of Java, capital of the residency of Sourabaya, on the Strait of Madura. It has a large harbour extensively fortified, and is the army and navy head-quarters of the Dutch East Indies. Batavia is connected by a single-track railway (500 miles). Trade centres round rice, tobacco, copra, coffee, and native produce. Pop. 160,000.

Sourakarta, or **Surakarta,** a city of Java, capital of the residency of Sourakarta, on the Pepé River. It is the head-quarters of a prince tributary to the Dutch, and is connected by rail with Semarang and Sourabaya. Pop. 20,000.

Souslik, the name of rodent mammals belonging to the genus Spermophilus of the squirrel family (Sciuridæ), and including about forty species native to the Northern Hemisphere.

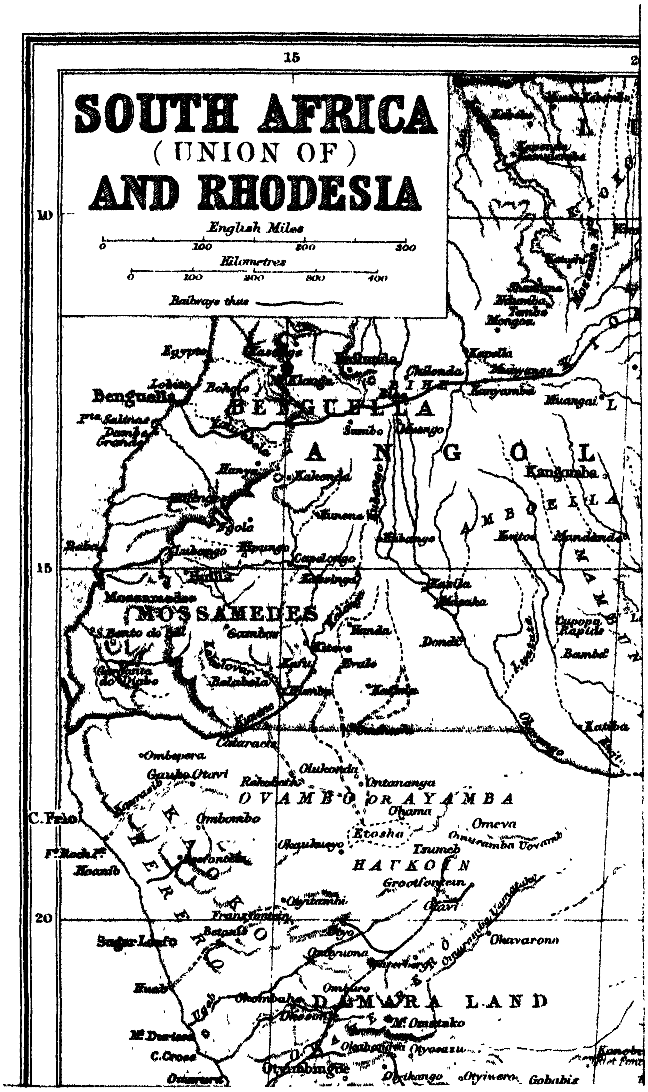
South, Robert, British divine, born in 1634, died in 1716. Educated at Westminster School and Christ Church, Oxford, he was chosen public orator of the University of Oxford in 1660. In 1676 he went to Poland as chaplain to the English Ambassador, and on his return became rector of Islip, in Oxfordshire. He was reckoned the most celebrated preacher of his day.

South Africa, Union of, comprises the four provinces of Cape of Good Hope, Transvaal, Orange Free State, and Natal. Area, 473,090 sq. miles; pop. 6,930,000 (5,400,000 being coloured). The Union seat of government is Pretoria; Cape Town is the seat of legislature. *Government.*—Executive power is in the hands of (1) a Governor-General appointed by the king; (2) an Executive Council nominated and summoned by him, comprising the king's ministers of State. Legislative power is exercised by Parliament, which is bicameral, and is presided over by the king, in the person of the Governor-General. The Senate comprises 40 members (8 elected by each province and 8 nominated), and the House of Assembly, 134 members (elected by electoral divisions, of which the Cape has 51, Natal 17, Transvaal 49, and Orange Free State 17). No member can sit in both Houses simultaneously. There are Provincial Councils (Cape 51 members, Transvaal 49, Orange Free State 25, Natal 25), elected for three years, each with an Executive Committee (4 members, not necessarily Council members), presided over by an Administrator, who is appointed by the Governor-General, and holds office for five years. English and Dutch languages are on an equal basis, and the coinage and weights and measures are British. However, some old Dutch measures, &c., are still in use, e.g. the *morgen* = 2·116 acres. See articles on the provinces; *Africa*; *Rhodesia*; *South-west Africa Protectorate*; *Smuts*; *Botha*; *Kruger*; &c.

Languages.—The Union of South Africa presents the phenomenon of the corrupted or dialectical form of another European language enjoying equal rights with English in a British dominion. Taal or Cape Dutch derives its name from the Dutch word *taal*, meaning language or speech, as in *de Nederlandsche taal*, the Dutch language. It is characterized by its exceedingly limited vocabulary; but a purer Dutch, namely, the Dutch of the Bible and the Catechism, has always been used in a greater or less degree by the better-educated classes. Taal is a patois based on the Dutch language of the early seventeenth-century settlers, and bears little resemblance to modern Dutch, for it has been developed in isolation, and the earlier colonists were of the poorer classes, whose language was simple. As a consequence, there is no South African literature so far as Taal is concerned. The majority of South Africans are conversant with both Cape Dutch and English. Bryce, in his *Impressions of South Africa*, says:

> To an Englishman or American who knows how rapidly his language has become the language of commerce over the world; how it has almost extinguished the ancient Celtic tongues in Scotland and Ireland; how quickly in the United States it has driven Spanish out of the south-west, and has come to be spoken by the German, Scandinavian, and Slavonic immigrants whom that country receives, it is surprising to find that Dutch holds its ground stubbornly in South Africa.

Such words as *drift*, a ford; *fontein* (as in Bloemfontein, &c.), a fountain; *trek*, to journey, or the length of a journey; and *veld*, applied to open plains, are all of Dutch derivation and are in



SOUTH AFRICA (UNION OF) AND RHODESIA

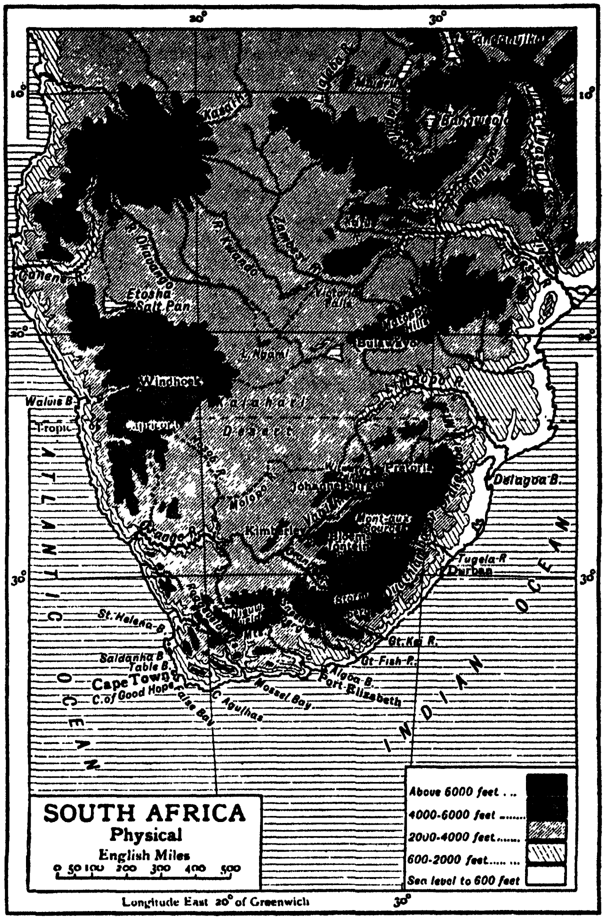
S

e
d
t
t
a
M
S
S

I
I
e
r
t
I
I
I

everyday use in South Africa, and appear in many geographical names.

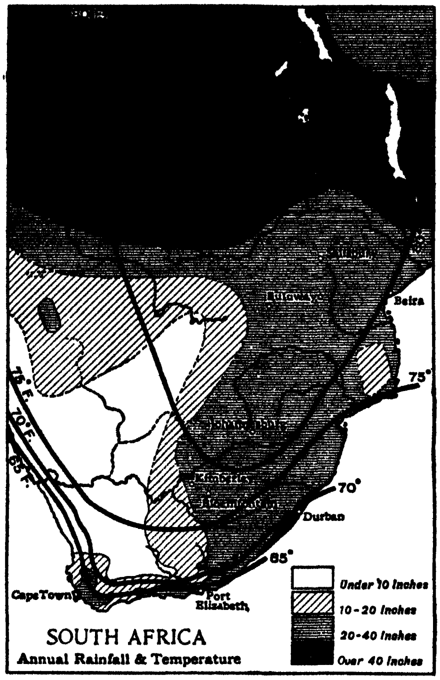
Recent History.—The origins of the South African War (1899–1902) must be traced to the circumstances in which the two Boer Republics, the Transvaal and the Orange Free State, came into existence, and to the new conditions created by the discovery of gold in the Transvaal. Great Britain had acknowledged the independence of both Republics in 1852–4, but, on the ground that misgovernment in the Transvaal constituted a danger to the neighbouring British colonies, the Transvaal was annexed in 1877. Three years later the Transvaal Boers rebelled, and defeated a British force at Majuba Hill (26th Feb., 1881), after which Gladstone's Government rescinded the annexation and recognized the independence of the Republic under the suzerainty of the British Crown. The agreement of 1881 was confirmed by the Convention of London (1884). In the same year gold was discovered in the Transvaal, and the Convention provided for the protection of foreigners, who, at the invitation of the Boer Government, built up, by their own labour and capital, a great mining industry. The new industrial population soon outnumbered the Boer farmers, who, rather than form a political minority in their own country, refused to give the Uitlanders, or foreigners, any share in the administration of the Republic, and even amended the franchise laws so as to render it practically impossible for an alien to obtain the rights of citizenship. This was in contravention of a promise given by the President of the Republic, Paul Kruger, and under his rule the Uitlanders suffered from oppressive taxation and misgovernment. When the Unionist Government of 1895 came into power in Great Britain and the new Colonial Secretary, Joseph Chamberlain, roused fresh enthusiasm for imperial interests, the Uitlanders hoped for a redress of their grievances, but any chance of a peaceful British intervention on their behalf was destroyed by a futile attack, known as the Jameson Raid (see *Jameson*), which was made by the administrator of the British colony of Rhodesia in command of troopers in the service of the British South Africa Company. Jameson was captured (2nd Jan., 1896), and President Kruger demanded an acknowledgment by the British Government of the complete independence of the Transvaal or South African Republic.



The demand was refused, and for three years Sir Alfred (afterwards Viscount) Milner, British High Commissioner to South Africa, tried to persuade Kruger to restore the old privileges enjoyed by foreigners before 1889, and to allow those who had been resident in the Transvaal for five years to elect about one-fifth of the members of the Volksraad, or Parliament of the Republic. Kruger declined any compromise, and, having formed an alliance with the Orange Free State (which had no quarrel with Great Britain), he sent an ultimatum to the British Government (9th Oct., 1899) demanding the removal of some troops which had been sent to Cape Colony and Natal as reinforcements, and repudiating the

British claim to interfere on behalf of the Uitlanders. War began on 12th Oct., and the self-governing Dominions of Canada, Australia, and New Zealand supported the British cause, and sent troops to the assistance of the Imperial armies.

The history of the war falls naturally into three stages. The British Government did not at first realize the serious nature of the military problem, which included not only an invasion of the Boer states, but the defence of Cape Colony and Natal, and the suppression of a rebellion in Cape Colony. The Boers at once invaded both the British colonies, and within a few weeks British armies were surrounded in the towns of Ladysmith (in Natal), Kimberley, and Mafeking (in Cape Colony). The forces under General Sir Redvers Buller, who became Commander-in-Chief in South Africa, were inadequate for their task, and there was a series of disasters in Dec. General Gatacre was defeated at Stormberg by Boers and Cape Colony rebels (10th Dec.). Next day Lord Methuen, who had made considerable progress towards the relief of Kimberley and had won three battles, was heavily repulsed at Magersfontein. On 15th Dec. Buller, who was advancing towards Ladysmith, was defeated at Colenso, on the Tugela River, which he tried to cross by a frontal attack upon a well-posted Boer army. The effect of this 'Black Week' was to rouse the country to fresh efforts, and Lord Salisbury's Government secured the services of the veteran Lord Roberts, who, at the age of sixty-seven, undertook the duty of retrieving the situation. He was accompanied by Lord Kitchener as Chief of Staff, and large reinforcements were sent out. Before Lord Roberts reached Capetown, the Boers had made a supreme effort to capture Ladysmith, and its defence on 6th Jan., 1900, was a notable incident in the melancholy history of the first three months of the war. A further effort by General Buller, on 23rd Jan., resulted in a disaster at Spion Kop, in which great losses were incurred.



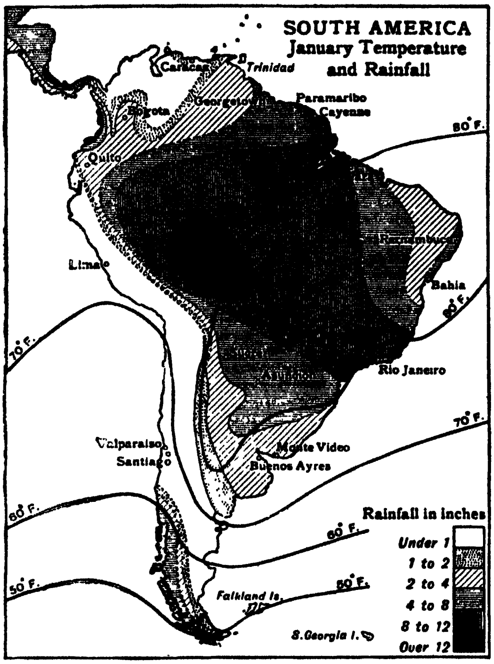
SOUTH AFRICA
Annual Rainfall & Temperature

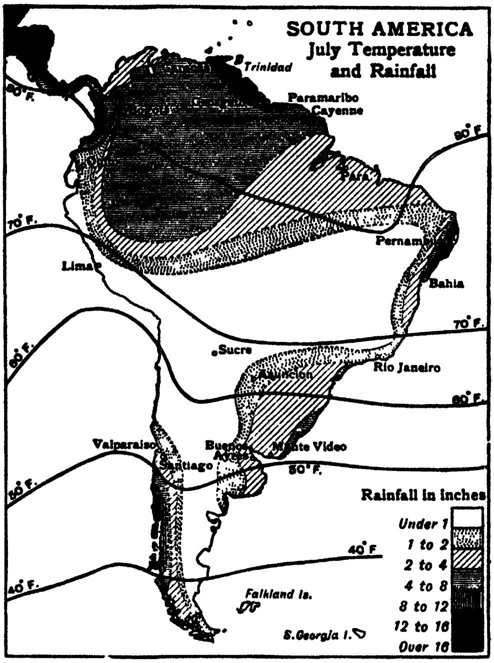
In the second stage of the war, the beleaguered garrisons were relieved, and Lord Roberts invaded the Transvaal and the Orange Free State. The first success was the relief of Kimberley on 15th Feb., followed by a brilliant stroke against the besieging army under Cronje. The Boer leader, with a force of 4000 men, was surrounded, and surrendered at Paardeberg (27th Feb.). On the following day Buller effected the relief of Ladysmith, after a four months' siege. The other besieged garrison, holding the small town of Mafeking, was not relieved until 18th May. After the strategic movement which brought about the surrender of Cronje, Lord Roberts continued his invasion of the Orange Free State, and entered the capital, Bloemfontein, on 13th March, the enemy giving way before him. His further movements were retarded by the loss of a large convoy in the middle of Feb., and the rapid movements, necessary for the relief of Kimberley and the encirclement of Cronje's force, had exhausted his horses. It was necessary to remain at Bloemfontein to restore both men and animals and to receive fresh supplies from his distant base, and the delay gave the Boers time to recover from the series of blows they had received. On 1st May the advance was resumed, and met with considerable opposition near Kroonstad and on the Vaal River, and again in front of Johannesburg, which was taken on 31st May. Lord Roberts's rapid movements had prevented General Botha from offering a vigorous defence of the great mining centre. On 3rd June the march was resumed, and two days later Roberts entered Pretoria. Botha's army withdrew to a strong position on Diamond Hill, about 15 miles distant from Pretoria, from which Roberts drove them on 12th June. He was, however, unsuccessful in an attempt to force the Boers to fight a decisive battle. They had already found a great guerilla leader in General Christian de Wet, and they determined to reserve their forces for a prolongation of the struggle.

After occupying Bloemfontein, Lord Roberts had issued a proclamation of the annexation of the Orange Free State (28th May), and when he had completed the series of military operations which seemed to have secured the conquest of the Transvaal, the annexation of the South African Republic was proclaimed (1st Sept.). In Nov. Lord Roberts handed over the command to Lord Kitchener, and by that time the war had already entered upon its third and longest stage. The Boer leaders continued their guerilla warfare for a year and a half more. No important action was fought during that long period, but Lord Kitchener had to organize a series of 'drives' for the purpose of surrounding the scattered Boer commandoes, and to establish a system of *block-houses* for the protection of the country which had been cleared. These operations were costly, both financially and in life, and though they were ultimately successful, the Boers from time to time were able to deal serious counter-blows, and on one occasion captured a British general (Lord Methuen). At last (31st May, 1902) the Boer leaders accepted the terms offered to them by Lord Milner and Lord Kitchener at Vereeniging. The Treaty of Vereeniging provided for the acknowledgment of the authority of the British Crown in the two former Republics (which had been renamed the Orange River Colony and the Transvaal Colony), and for the surrender of their arms by the Boer forces still in the field; but, apart from these two essential conditions, its terms were so generous as to lay the foundation of future conciliation. It was promised that the temporary form of civil government which, on the close of hostilities, replaced martial law should soon be followed by the grant of representative institutions, and ultimately by self-government; that the Dutch language should be taught in the schools; and that a sum of £3,000,000 should at once be placed at the disposal of Lord Milner and his colleagues for purposes of reconstruction.

These promises were amply kept. The work of reconstruction had already been begun during the last stages of the war, and made rapid progress in the next three years. Before Lord Milner left South Africa (1905), he proposed to give the new colonies a liberal measure of representative government, and what was known as the Lyttleton Constitution (from the name of the then Secretary for the Colonies) received the royal sanction in March of that year. It never came into actual operation, for when Sir Henry Campbell-Bannerman came into office, in the end of 1905, he announced his intention of responding to an appeal by Botha and other Boer leaders for the immediate grant of responsible government. The newly issued Constitution, designed as 'a school of self-government', was revoked, and in 1906 responsible government was granted, and the new colonies received complete control of their own affairs. The new Constitution was accompanied by the abolition

of a system of Chinese labour, which had been sanctioned by Lord Milner in order to provide for the restarting of the mines, and had roused a fierce controversy both in South Africa and at home. The introduction of responsible government, within four years from the conclusion of the struggle, was a bold experiment, but it was justified by the conduct of South African affairs by General Botha, and it produced a movement for the federation of the South African colonies. Natal, the Cape of Good Hope, the Transvaal, and the Orange Free State (which reverted to its older title) formed the Union of South Africa (1909), with a status like that of the Dominion of Canada and the Commonwealth of Australia. Rhodesia is the only South African colony outside the Union, and it refused incorporation in 1922. The last echoes of the South African War may be traced in a rebellion (Oct. to Dec., 1914) which occurred at the outbreak of the European War, but was easily suppressed by Botha. The part played by the Union of South Africa in the great struggle with Germany was a proof of the statesmanship which inspired and followed the Treaty of Vereeniging. (See *Smuts*; *Botha*; &c.) Earlier history is summarized under the four individual provinces.—Bibliography: *The Times History of the War in South Africa*; Sir A. Conan Doyle, *The Great Boer War*; John Buchan, *The African Colony.*

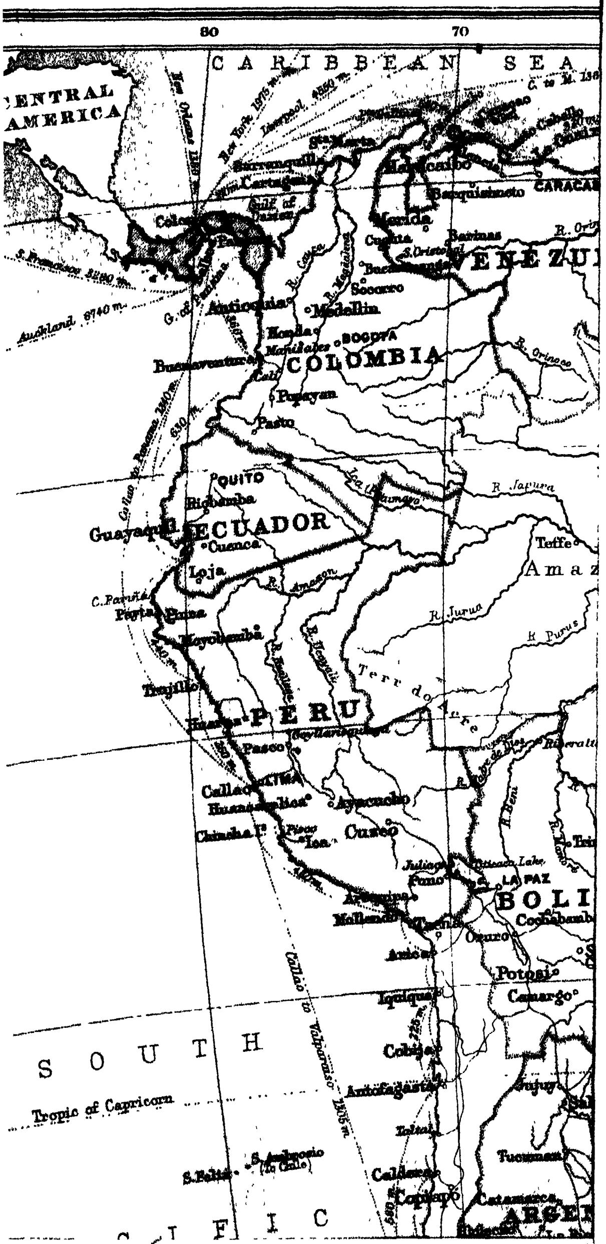




South America, the southern portion of the Western Continent or New World, extending southwards from the Isthmus of Panamá, and embracing the Republics of Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela, and the colonies of Guiana. Brazil occupies about half of the continent, and is Portuguese in origin and history; the other states are of Spanish origin. The total area is about 7,000,000 sq. miles, and the pop. (approximately) 84,000,000. See *Geography* (under *Land Forms*); *America*; and articles on the various countries.

Southamp'ton, Henry Wriothesley, third Earl of, born 1573, died 1624, famous as the patron of Shakespeare, who dedicated to him the poems of *Venus and Adonis* and *The Rape of Lucrece.* He has been identified with the young man addressed in the *Sonnets*, with Mr. W. H. of the dedication, and with both. See *Shakespeare.*

Southampton, a county and municipal borough and seaport of Hampshire, England, on a peninsula at the mouth of the Itchen, near the head of Southampton Water, 79 miles south-west of London by the London & South-Western Railway. It consists of an old and a new town, the former at one time surrounded by walls flanked with towers, of which portions still remain; and entered by several gates, of which three, still standing, bear the names of West Gate, South



80
70
CARIBBEAN SEA
CENTRAL AMERICA
New Orleans 1380 m.
New York 1975 m.
Liverpool 4850 m.
C. to M. 138
S. Francisco 3280 m.
Auckland 6740 m.
Sta Marta
Barranquilla
Cartagena
Gulf of Darien
Colon
Panama
G. of Panama
Maracaibo
Caracas
Barquisimeto
Merida
Barinas
Cucuta
S. Cristobal
Bucaramanga
R. Orinoco
VENEZU
Socorro
R. Cauca
R. Magdalena
Antioquia
Medellin
Honda
Manizales
BOGOTA
Buenaventura
Cali
COLOMBIA
Popayan
Pasto
Callao to Panama 1340 m.
630 m.
QUITO
Riobamba
Guayaquil
ECUADOR
Cuenca
Loja
R. Japura
R. Putumayo
Teffe
Amaz
R. Amazon
C. Parina
Payta
Piura
Moyobamba
R. Jurua
R. Purus
R. Huallaga
R. Ucayali
Terr do Acre
Trujillo
Huaraz
PERU
Pasco
Callao
LIMA
Huancavelica
Ayacucho
R. Madre de Dios
Riberalta
R. Beni
R. Mamore
Chincha Is
Pisco
Ica
Cuzco
Juliaca
Titicaca Lake
Puno
LA PAZ
BOLI
Arequipa
Mollendo
Tacna
Oruro
Cochabamba
Arica
Potosi
Camargo
Callao to Valparaiso 1315 m.
Iquique
SOUTH
Cobija
Antofagasta
Tropic of Capricorn
Taltal
Jujuy
S. Felix
S. Ambrosio (to Chile)
Caldera
Copiapo
Tucuman
Catamarca
ARGE
PACIFIC

Gate, and Bar Gate. The last, an embattled and machicolated structure large enough to contain the guild-hall in the upper part of it, is now, owing to the growth of the town, nearly in its centre, and, being placed across the principal street, divides it into two parts, that to the north being named Above-bar, and that to the south Below-bar or High Street. There is a University College, a grammar-school dating from 1550, and two churches (Holy Rood and St. Michael) of ancient foundation. There is ample dock accommodation, extended during the European War, and Southampton is the most important mail-packet station in the kingdom. The industries are varied.

The town arose from the decay of the Roman station *Clausentum*, at Bittern, became a mint town under Athelstane, and is mentioned as Hantun (Hantune) in *Domesday Book*. It was the jumping-off place for the French expeditions of Edward III and Henry V. It suffered a severe set-back from the rise of Portsmouth, but revived with the arrival of the railway in 1810. The first charter was granted by Henry I. Pop. (1921), 160,997.

South Australia, a state of the Australian Commonwealth, comprising the south-central region of the Australian continent.

Area and Population.—The total area is 380,070 sq. miles (see table of comparative areas under *Queensland*). The pop. (1921) is 495,340, compared with (1846) 22,390. Adelaide is the capital (pop. 1921, 255,320, i.e. over 51 per cent of the total population of the state); urban incorporated areas include: Port Adelaide (30,120), Unley (34,110), Hindmarsh (12,461), Norwood and Kensington (15,010), Thebarton (14,040), Port Pirie (9900), and Glenelg (8000).

Physiography.—South Australia has a coast-line of 1540 miles, i.e. there are 247 sq. miles of territory to every mile of coast-line. The seaboard extends along the eastern half of the Bight; the adjacent islands, e.g. Kangaroo Island, Investigator group, and Thistle Island, are included in the state. Professor Gregory divides South Australia into four regions: (1) the western prairie-plateau, lying west of Lake Torrens, and separated by (3) the Rift Valley of South Australia from the South Australian Highlands. (The Highlands extend south-westwards from Mount Babbage, east of Lake Torrens, through the Mount Lofty range to Cape Jervis; the Rift Valley includes Lake Torrens, which is below sea-level, and Spencer's Gulf.) Occupying the south-eastern corner of the state is (2) the basin of the Lower Murray; (4) is the Lake Eyre basin. Rivers include the Lower Murray, and the intermittent Torrens, Hindmarsh, Tuman, Gawler, and Wakefield. From the map, South Australia appears exceptionally rich in large inland lakes; but it is not so, for the 'lakes' shown are usually salt, not infrequently mere 'dry pans', and only of full extent when the basins are flooded by the rivers. In region (2) there are small basaltic vents or puys of Upper Cainozoic to recent age, ranging for 35 miles between Mount Schank and Mount Graham. Mount Gambier is the largest cone, and the crater forms Brown's Lake. *Climate.*—South Australia is very healthy, and enjoys a moderate but reliable rainfall, May and June being the wettest months in the settled regions, January in the north and north-east. The climate is roughly Mediterranean, or, more narrowly, Sicilian; the Lake Eyre district is the driest known part of Australia, and the interior generally is very hot in summer.

Communications.—There are 3458 miles of railways (1920–1), of which 1075 are Federal- and 2333 State-owned. In 1861 the mileage was 56. The Federal Port Augusta-Oodnadatta line (477 miles of 3-ft.-6-in. gauge) is operated by the State. Linking Westralia with the eastern states is the Federal, Port Augusta-Kalgoorlie (West Australia) line (1051 miles of 4-ft.-8½-in. gauge). This trans-Australian line was commenced from both ends in 1912–3, and the sections met on 17th Oct., 1917. About 1120 miles of State line are of 5-ft.-3-in., and 1209 of 3-ft.-6-in. gauge. Federal lines have 597 miles of 4-ft.-8½-in., and 478 miles of 3-ft.-6-in. gauge. (See *New South Wales*, under *Communications.*) South Australia has 9·06 miles of railway per 1000 sq. miles, and 7·29 per 1000 persons.

Production: Agriculture.—In 1919 roughly 115,000,000 of a total of 243,245,000 acres were unoccupied. Wheat is by far the chief crop, and 68 per cent of the cropped area is under it. Vineyards, barley, and oats are next in importance. Fruit-raising is popular, and apples, apricots, peaches, strawberries, quinces, &c., are produced. Sheep-farming is progressive. *Irrigation, &c.*—There are many irrigation-lands. South Australia has 90,000 sq. miles of the Great Australian artesian basin, part of the Eucla basin (south-west), and part of the Lower Murray basin, and is well supplied with artesian water. (See note *Artesian Basins* under *Queensland.*) *Mining.*—Ironstone (Port Clinton, Ardrossan, &c.), copper, salt, opal, gypsum (S. Yorke Peninsula), gold, limestone flux, and phosphate. 21,000,000 tons of ore is estimated to be in sight in the Iron Knob and Iron Monarch, veritable hills of iron. Bismuth is found at Balhannah, Mount Macdonald, and Murinnie (Spencer's Gulf), and gold round Adelaide, with Deloraine and Tarcoola as chief centres. *Fisheries.*—These are valuable, and good trawling-ground (4000 sq. miles) exists in the Bight, midway between Adelaide and Albany (i.e. two days' steaming either way). Rock-ling and flathead are varieties of fish caught by the *Endeavour* expedition. *Forests.*—The state is the most lightly timbered region of Australia. The hills encircling Adelaide and the Eyre and Yorke Peninsulas bear good forests, but the Bight and Encounter Bay littorals have little timber. *Manufactures.*—Of these the chief are connected with metal-work and machinery, clothing, food and drink, vehicles and saddlery, and the treatment of raw materials produced by agricultural industries.

Religion.—Anglicans predominate, with Methodists second, and Roman Catholics third. There are roughly 800 Jews and 600 Mahommedans and Confucians, besides 2200 (approximately) other non-Christian people. Religion receives no State assistance.

Education.—The University of Adelaide grants degrees in arts, science, medicine, law, and music. There is a Teachers' Training College, and the school of mines at Adelaide has five affiliated colleges. Education is secular, free, and compulsory, and governmental bursaries and scholarships are awarded for university and technical training.

Government.—There is a Governor, who is appointed by the Crown, and an Executive Council, comprising 6 responsible ministers and the Chief Justice of the Supreme Court. Executive power is vested in the Governor in Council. The state possesses a bicameral legislature: (1) a Legislative Council (20 paid members from five electoral districts, one-half retiring triennially), and (2) a House of Assembly (46 paid members from nineteen electoral districts, sitting for three years). Payment of members (both Houses) is at the rate of £200 per annum, plus a free pass over Government railways. See *Australia*, and articles on other states of the Commonwealth.

South Bend, a city of Indiana, United States, the county seat of St. Joseph county, on the southern bend, and at the head of navigation on the St. Joseph River. It has the largest carriage- and wagon-works in the world (Studebaker Brothers Manufacturing Company). Other manufactures are agricultural implements, woodwork (Singer Manufacturing Company), steel, iron, flour, and paper-pulp. Pop. 71,000.

Southcott, Joanna, religious fanatic, born 1750, died 1814. Carried away by a heated imagination, she gave herself out as the woman spoken of in the *Book of Revelation* (chap. xii). She announced herself as the mother of the promised Shiloh, whose birth was to take place on the 14th Oct., 1814. Her followers long confidently anticipated her speedy resurrection. They numbered at one time as many as 100,000, but are now extinct.

Southend-on-Sea, a county and municipal borough and watering-place of Essex, England, on the estuary of the Thames; served by the Midland and Great Eastern Railways. It is a popular resort of Londoners, and has a large pleasure-pier, kursaal, baths, &c. Pop. (1921), 106,000.

Southern Cross, a constellation of the southern hemisphere, composed of four stars, one of which is of the first, and two of the second magnitude. They form a well-shaped cross, especially conspicuous when seen above the pole. The Southern Cross is the best known of the southern constellations.

Southerne, Thomas, English dramatist, born in 1660, died in 1746. Educated at Trinity College, Dublin, he was called to the Bar at the Middle Temple, but soon abandoned the law for dramatic literature. He wrote in all ten plays, of which the most popular were *The Fatal Marriage* and *Oroonoko*.

Southey, Robert, Poet Laureate, prose-writer, and historian, was born in 1774, and died in 1843. He was educated at Westminster, whence he had the honour of being expelled for writing an article against flogging, and at Balliol College, Oxford, where he studied swimming and boating, and did not graduate. He became intimate with Coleridge, whose wife's sister, Edith Fricker, he married in 1795. Like many other men, Southey began life as a pantisocratic deist and gradually became a conservative Anglican. He has been blamed (especially by Whig contemporaries) for his tergiversation, but his change of views, which was aided by the progress of the French Revolution, was quite sincere and not uncommon. Southey, like Goldsmith, coquetted with each of the three learned professions in turn. His views were too unorthodox for the Church; he disapproved of the dissecting-room; the study of law he found 'laborious indolence'. Finally he adopted literature as a profession, and, after a wandering life, settled in Sept., 1803, at Greta Hall, Keswick. He shared this house with the Coleridge family, and by means of unremitting study and toil he supported not merely his own but also Coleridge's family. His literary output was enormous. His works include: *Joan of Arc* (1795); *Thalaba* (1801); *Madoc* (1805); *The Curse of Kehama* (1810), the best of his long poems; *Roderick* (1814); *History of Brazil* (1810–9); *Life of Nelson* (1813); *Life of Wesley* (1820); *A Vision of Judgment* (1821); *History of the Peninsular War* (1823–32); and *The Doctor* (1834–47), a curious cross between a commonplace book and a novel. Southey worked incessantly in his library, which contained 14,000 volumes. He wrote in all some ten volumes of verse and forty of prose. To the indignation of all good Whigs Southey was made Poet Laureate in 1813, but as he succeeded the poetical Pye (' poetris pica ' of Persius's prologue), who in his turn succeeded several nonentities, he may be considered to have restored the office to some of the glory conferred on it by Dryden. At the age of forty-three he had the mortification of being confronted with a revolutionary effusion named *Wat Tyler*, which he had written at the age of twenty, and which was published without permission. His old age was a sad one, for his wife became insane in 1835 and died in 1837. In 1839 he married the poetess Caroline Anne Bowles (1787–1854), but his mind, overtasked for many years, gave way in 1840.

Southey is not to be judged by the gibes of Byron or the sneers of the American writer Emerson. His poems, if not supremely great, are admirable, and are unworthily neglected, with the exception of some famous short poems, such as *The Battle of Blenheim* and *The Holly Tree*. His prose is always excellent, and is distinguished for its total lack of mannerism. His *Life of Nelson* is the best of all short biographies—better even than Tacitus's *Agricola*. His *Life of Wesley* is inferior only because it is more prolix, and its subject less interesting. Southey may be described as a good poet, a better prose writer, and a very good man. Next to Scott he is one of the most lovable of British authors.—BIBLIOGRAPHY: E. Dowden, *Southey* (English Men of Letters Series); J. Dennis, *Robert Southey: the Story of his Life written in his Letters*; C. Browne, *Life of Robert Southey*; J. Cottle, *Reminiscences of S. T. Coleridge and Robert Southey.*

South Georgia, a British island in the South Atlantic, a dependency of the Falklands. It is mountainous and glacier-capped, and is a whaling- and sealing-ground. Area, 1000 sq. miles. Except for the whalers and sealers there is no population.

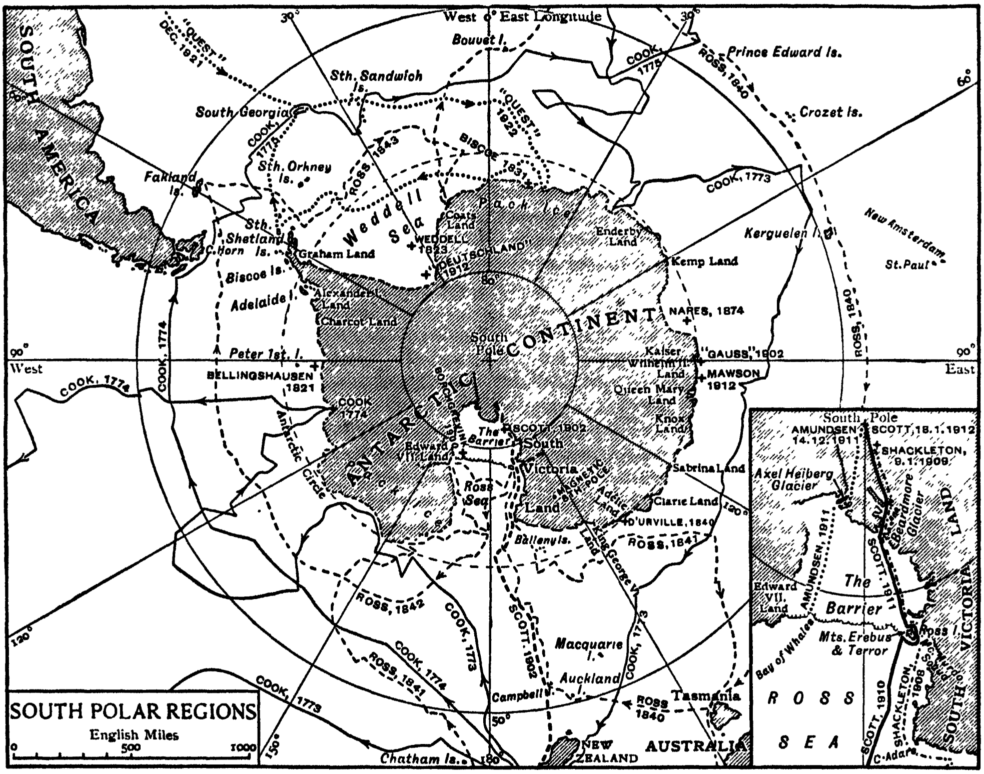
South Island, the largest of the New Zealand group. The Southern Alps traverse the island longitudinally, and on their eastward side is the rich wheat-growing region of the Canterbury plains. Christchurch and Dunedin are the chief towns. Area, 58,120 sq. miles; pop. 476,000.

South Kensington Museum. See *Victoria and Albert Museum.*

South Orkneys, a British archipelago in the South Atlantic, a dependency of the Falklands. Coronation Island is the largest; a meteorological station is maintained on Laurie Island. Area, 800 sq. miles.

South Polar Expeditions, exploring expeditions in the Antarctic regions. Captain Cook (*Resolution*) is the first who is known to have sailed within the Antarctic Circle. He reached the southernmost point attained during the eighteenth century on 30th Jan., 1774, viz. 71° 10′ s. and 106° 54′ w. In 1821 a Russian, Fabian von Bellingshausen (*Vostok*), discovered Peter the Great (now Peter I) Island and Alexander I Land. James Weddell (*Jane*) sailed in 1823, and made a collection of Antarctic fauna. He discovered the George IV Sea, now known as the Weddell Sea. Enderby Land, Adelaide Land, Biscoe Islands, and Graham Land were discovered by Biscoe (*Tula*) in 1831–3. Sabrina Land and Balleny Islands were discovered in nearly the same latitude by Balleny in 1839 (*Eliza Scott*). In 1840 two important exploring expeditions, one French, the other American, reached the southern seas. The French expedition, under Dumont d'Urville (*Astrolabe* and *Zelée*), was at first most unfortunate, but eventually discovered Adélie Land. The American expedition, under Wilkes, passed very near the southern magnetic pole, the position of which at the time he calculated to be lat. 70° s., long. 140° E., and traced land from long. 154° 27′ to 97° 30′ E., which Wilkes concluded to be continuous. An English expedition, under Captain James Clark Ross (*Erebus* and *Terror*), in 1841 passed the Antarctic Circle about long. 178° E., and in 172° 36′ E. long. and 70° 41′ s. lat. found a continuous coast trending south, with mountain peaks 9000 to 12,000 feet in height. The farthest south point reached by Ross was 78° 10′ lat., and this long remained the farthest south latitude attained. The achievements of Ross are perpetuated in the name of the twin volcanoes Erebus and Terror, and the Ross Sea. H.M.S. *Challenger* was the first *steamer* to cross the Antarctic Circle. She was engaged in oceanographical research under Sir John Murray (q.v.). In 1895 M. Borchgrevink and the captain of the *Antarctic* landed at Cape Adare, the first to set foot on the mainland of the Antarctic continent. In the *Southern Cross* Borchgrevink attained 78° 50′ s. In 1901 the British National Antarctic Expedition, under Captain R. F. Scott, left in a specially constructed wooden ship of 700 tons, the *Discovery*; a German expedition in the *Gauss* sailed in co-operation and discovered Kaiser Wilhelm Land; and two private expeditions, under Nordenskjöld (*Antarctic*) and Bruce (Scottish expedition in the *Scotia*), were also sent out.

Perhaps the greatest of all Antarctic expeditions was that equipped privately by Shackleton in the whaler *Nimrod* (1908–9), when a distance 97 miles from the true Pole was reached, in a magnificent dash over a plateau 11,600 feet altitude. Food shortage prevented the completion of the journey. During 1910–2 Captain R. F. Scott sailed in the *Terra Nova*, and his party reached the South Pole on 18th Jan., 1912, to find that they had been forestalled by the Norwegian Roald Amundsen and the *Fram* party, who had reached the Pole on 14th Dec., 1911, and had remained there two days. The tragedy of Scott's return journey startled the whole civilized world. Dr. (afterwards Sir Douglas) Mawson's (*Aurora*) Australian Expedition (1911–4), and the German (*Deutschland*) Expedition under Filchner, carried on observations which were continued by Shackleton in the *Endurance* (1914–6), which was ordered by the Admiralty to proceed as arranged on the outbreak of the European War. The *Endurance* was crushed in the ice, and the party made a perilous return to South Georgia. The *Aurora* (1914–7) party, under Mackintosh, explored the Ross Sea area. The personnel of both sides of the expedition subsequently served in the European War. On 24th Sept., 1921, the Shackleton-Rowett expedition left Plymouth in the *Quest*, a Norwegian wooden ship of 700 tons. Sir Ernest Shackleton was in command. Ill-luck dogged the expedition from the start; on account of bad weather, a refit at Rio de Janeiro became necessary, and Shackleton himself died (5th Jan., 1922). The expedition proceeded, however, under Commander Frank Wild. Leaving South Georgia on 17th Jan., and sailing via Zavodovski Island (reached on 20th Jan.), a farthest-south point was reached in 69° 18′ S. lat., 17° 11′ E. long., when the *Quest* swung westward by Elephant and Clarence Islands (28th Jan.) back to South Georgia (6th April), and then via Inaccessible Island, Tristan da Cunha, and Gough Island to Cape Town (18th June), and England (16th Sept.). Much useful hydrographic work was performed, e.g. St. Paul's Rocks charted, many soundings taken, charts and surveys made, and much information obtained for *Sailing Directions*. The geological work was confined to the islands visited, but some deep-sea oozes, &c., were obtained.—BIBLIOGRAPHY: R. Amundsen, *The South Pole*; Sir E. Shackleton, *South*; *Heart of the Antarctic*; R. F. Scott, *Voyage of the 'Discovery'*; James Weddell, *A Voyage towards the South Pole*; J. C. Ross, *A Voyage of Discovery and Research in the S. and Antarctic Regions*; R. N. R. Brown, &c., *Voyage of the 'Scotia'*; H. G. Ponting, *The Great White South*; Captain F. R. G. R. Evans, *South with Scott*.



Southport, a county and municipal borough and watering-place of Lancashire, England, near the estuary of the Ribble, 18 miles from Liverpool. Among the attractions of the town are the Pavilion and Winter Gardens, which include a concert-hall, gardens, marine and freshwater aquaria, &c.; the botanic gardens, Hesketh Park, promenades, and a pier 1480 yards in length. Pop. (1921), 77,000.

South Sea Bubble. The commercial panic of 1720, known as the South Sea Bubble, originated in an arrangement by which a company trading with South America was to take over the National Debt (then about £50,000,000) in return for the grant of a trading monopoly. The Government was to pay interest on the Debt for twenty-five years, and the company, out of its profits, was to repay the capital during that period. The agreement produced unbounded confidence in the future of the South Sea Company; holdings in the Debt were eagerly exchanged for its shares; and the price of a £100 share soon rose to £1000. Other companies took the opportunity of exploiting the mania for speculation which seized the nation, and investors put their money into companies of which they knew nothing at all; some of them were formed for such objects as the discovery of perpetual motion. Legislation had to be passed to put an end to these frauds, a panic ensued, the shares of the South Sea Company, which was dishonestly managed, fell rapidly in value, and the company became bankrupt. Some of the Cabinet, including Aislabie, the Chancellor of the Exchequer, were involved in the frauds. The incident revealed the greatness of Sir Robert Walpole, who reorganized the National Debt, and, as far as possible, compensated the sufferers in the South Sea Company.

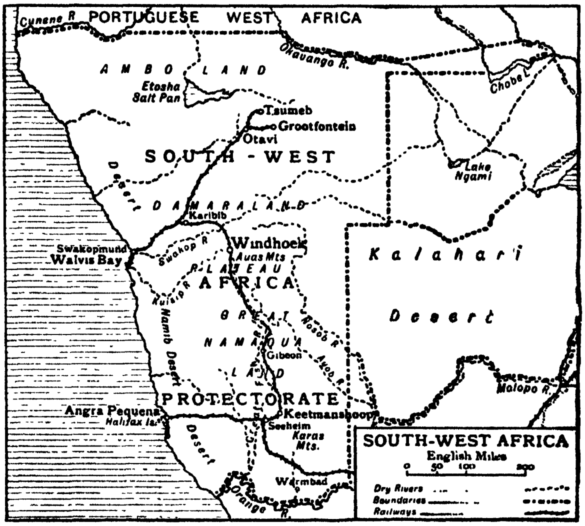
South Shetlands, a British archipelago in the Southern Ocean, a dependency of the Falklands. It is a sealing centre. Area, 880 sq. miles.

Southwark (colloquially 'The Borough'), a metropolitan and parliamentary borough of the county of London, south of the Thames, opposite the City of London, including the ancient St. Saviour's Church, now the cathedral of the bishopric of Southwark (founded 1905), Spurgeon's Metropolitan Tabernacle, Guy's Hospital, and Bethlehem Hospital. A new bridge across the Thames was opened in 1921. Pop. (1921), 184,388.

Southwell, a city of Nottinghamshire, England; served by the Midland Railway. It gives name to a diocese comprising Notts and Derbyshire, established in 1884. Pop. 3300.

South-West Africa Protectorate, a former German-African colony, now administered by the Union of South Africa.

Physiography.—The protectorate is bounded by the lower Orange River on the south, by the lower Kunene in the north-west, and by the Okavango River in the north-east. Between the Kunene and the Okavango the boundary line is arbitrary, as it is also to Bechuanaland on the east. Physically the country consists of the Namib, or coastal desert region, which extends along the whole length of the coast-line (Atlantic Ocean) for about 850 miles, and penetrates inland to a depth of from 30 to 80 miles. The Benguella Current makes it the scene of occasional dense sea-fogs. Behind the Namib the hinterland rises in terraces to (at about 100 miles from the coast) the escarpment of the Great Kalahari Plateau and the highland region, which extends eastwards, through the Central Plateau, to merge with the western extension of the Kalahari Desert. The Great Fish River (500 miles) is entirely within the colony, and is rarely dry; it is a tributary of the Orange. All other rivers are generally dry watercourses in the hot season, and it is a peculiarity of the aridity of the vast bulk of the region that the soil is so parched as to afford what drainage there is little chance of reaching the ocean or the frontier rivers. In very wet seasons the Kunene may overflow into the Etosha Pan (salt). Hot springs are found in various places, and water is usually



See Physical Map under *South Africa*

obtainable by digging in the river beds or by boring. There are two main seasons: (1) hot and humid (October to April), and (2) cool and dry (May to October). Although the country is tropical, the height of the Central Plateau (3500–5000 feet) modifies the latitude, and ensures an agreeable, bracing, sub-tropical climate resembling that of the High Veld of South Africa, with which, of course, it is physically one. The most convenient divisions are as follows: *Amboland*, the most densely peopled region. It lies in the extreme north. *Damaraland*, the central region, a land of alternate mountain and plain. *Namaqualand*, the semi-arid southern area, where drought is common in the south and central parts.

Caprivi Corridor.—This is a long, narrow extension of the Protectorate from its north-eastern corner, and, sandwiched between Angola (north), Northern Rhodesia (north), and Bechuanaland Protectorate (south), it provides an exit to the Zambezi and to Rhodesia. It came into existence in the old German days as a result of the shrewdness of the German Chancellor Caprivi (q.v.), the man who defeated the British Cape-to-Cairo aims by arranging for the abutment of the Belgian (Congo) and German (East Africa) frontiers, truly an insuperable barrier. (See *Rhodesia.*)

Area, &c.—The estimated area is 322,400 sq. miles, and the population (European, 1923) about 19,500, of whom 7500 are German; (native) 220,000. There is no feasible system of enumerating the natives, however, and all figures are, more or less, guesswork (see section *The People*).

Towns.—Windhoek is the capital, and Walvis Bay has superseded Swakopmund as chief port. Angra Pequena is the centre of the diamond industry; Keetmanshoop is a mining and railway centre and has engineering shops; Otavi is a copper-mining centre; and Karibib is a railway junction, and has a local production of coloured marble. Other towns are Tsumeb, Warmbad, and Gibeon. The latter is a missionary centre, and many such settlements throughout the colony have Biblical names.

Railways.—About 1067 miles of railway are open. In such a country as South-West Africa railways exercise an enormous influence upon internal development, and the disposition of the systems of the protectorate is of great interest. The nodal points are Walvis Bay and Angra Pequena.

1. Walvis Bay—Windhoek, via Swakopmund and Karibib. A line from Walvis Bay into Rhodesia will tap the Wankie coal-fields (see section *Southern Rhodesia*, under *Rhodesia*).

2. Karibib-Otavi< —Grootfontein,
—Tsumeb,

via Otjiwarongo where the Amboland Railway (2-ft. gauge) begins.

3. Angra Pequena-Keetmanshoop, via Seeheim, where the line to the Union of South Africa is thrown off, and runs via Kalkfontein (branch to Warmbad) to Prieska. During the European War the South African Government found it necessary to push through a line from Prieska to Kalkfontein via Upington. The German line was on the South African gauge (3-ft.-6-in.), so there was no break, and the Swakopmund-Windhoek line was converted from 2-ft. to standard gauge, and connected up with Walvis Bay, the only natural harbour on the coast. Gobabis is connected with Windhoek by a line 132 miles long (standard gauge).

4. The central system, extending across the Central Plateau between Windhoek and Keetmanshoop.

5. The diamond-fields line, running southwards for 74 miles along the coast from Kolmanskuppe (on 3 above). It is of 2-ft. gauge, and runs to Elizabeth Bay and Bogenfels.

Production.—Its abnormal mineral wealth makes South-West Africa a desirable possession for any progressive European nation. Its value to Germany lay originally in the fact that it was her only colony in Africa suitable for European colonization, but with the discovery of its hidden treasure (so recently that exploitation has only as yet begun) a new era was begun. Diamonds, small but of fine quality, were discovered in 1908, and are worked along a 275-mile stretch of the coastal region. Being taxed, they are at once the most valuable item of export and the principal source of revenue. Copper is next in value; and wolfram, vanadium, tin, and marble are also produced. Large deposits of iron (hæmatite and limonite) are reported in the north-west. Apart from its minerals, the protectorate is a pastoral country, and, excepting the more favoured parts, its general aridity forbids the raising of cereals without irrigation. Agricultural development is dependent on the engineer who provides the water. In the extreme north and east of Damaraland, cereals, maize, Kaffir corn, and tobacco have been raised successfully. However, there is a good all-round production of maize, and viticulture and cotton-growing are progressive. Excluding Germans, the chief settlers are South African farmers. See *Tsumeb*.

Karst Region.—This is located in the Grootfontein area, and the term is a geological one. It is a country of caverns, sink holes, and springs, without any clearly defined hydrographic system, and it slopes generally to the Etosha Pan. Here the average annual rainfall is above 20 in. and the whole area is fairly well wooded, and capable of raising potatoes, pumpkins, &c., maize, and Kaffir corn without irrigation. Fruit, including citrus, grapes, peaches, apricots, and apples, is produced in abundance.

Government.—Windhoek is the administrative head-quarters, and is the seat of the Administrator, who represents the Governor-General of the Union and the Union Parliament, and is assisted by an Advisory Council. There are seventeen districts, each presided over by a magistrate, and a Native Commissioner watches over Ovamboland and recruits natives for the railway system and the diamond-diggings. A Sub-Commissioner is stationed at Kuring Kuru, on the Okavango. Roman-Dutch law is the common law of the country. The Union of South Africa holds a mandate, dated 17th Dec., 1920, from the League of Nations, in respect of South-West Africa. This is drawn up on ' System C ', which means that the mandatory power may administer the territory as an integral part of its own domains, and, subject to modifications to suit local conditions, the Union laws are gradually being put into operation. Other terms of the mandate prohibit the sale of alcohol to natives, their forcible recruitment for labour or military training, except for police and defence, and no fortifications or military or naval bases may be established.

'Article 5 of the Mandate says: "Subject to the provisions of any local law for the maintenance of public order and public morals, the mandatory shall insure . . . freedom of conscience and the free exercise of all forms of worship, and shall allow all missionaries nationals of any state member of the League of Nations to enter into, travel, and reside in the territory for the purpose of prosecuting their calling.

The People.—The principal tribes are noted in the following table:

Tribe.	Number.
Ovambos	150,000
Hereros	20,000
Hill Damaras	20,000
Hottentots	14,500
Okavango and Caprivi 'Corridor' Natives ..	8,500
Bushmen	10,000
Ovatjimbas	8,000
[1] Bastards	3,500
Bechuanas	500
Total	235,000

[1] 5000 is the number given by the Union Government The figures in the table are those given by Tönnesen, who adds another 4000 to the non-European population for the 'natives and coloured people from abroad'.

History.—South-West Africa was 'discovered' by Bartholomew Diaz, who landed at Angra Pequena in 1487. Its modern history dates from the inauguration in Germany of ambitious schemes of colonial expansion which were considerably promoted by one F. A. E. Lüderitz, a merchant of Bremen, who founded a trading-post at Angra Pequena during 1883, and whose agents and concession-hunters speedily overran a large part of the hinterland. The territory was eventually lost to Great Britain by indecision and a deplorable lack of foresight, and on 22nd Sept., 1884, the German annexation was formally recognized, excepting Whale (Walvis) Bay, which remained British.[1] Lüderitz now gave place to Nachtigal, an Imperial Commissioner, but became a national hero, and made a fortune by selling out his interests in the colony to the newly born German South-West Africa Company. In Oct., 1903, the Bondelzwarts (Hottentots) rose, and the Herero also were in insurrection, and no effort was spared by the German generalissimo (von Trotha) to exterminate men, women, and children among the Herero, who lost over two-thirds of their number, and nearly all of their cattle—for the number of which they were rightly famous—in course of the campaign. Trotha was unsuccessful both as a soldier and an administrator, and in 1905 von Lindequist, a new governor, arrived. He worked for peace, and the 19,000 Herero who remained were granted an amnesty. About 3000, however, sought refuge in Bechuanaland. In 1906 the Hottentots rose again, and once more the Germans, with their poor communications and lack of water, had difficulty in suppressing them. During 1907 von Lindequist was superseded by von Schuckmann, who in turn gave place (1910) to Dr. Seitz, the governor responsible for the colony at the outbreak of the European War, when it was conquered by General Botha and the Union forces, and was surrendered at Khorab on 9th July, 1915 (see *European War*, section *The War in Germany's Colonies*). In 1918, after the general armistice, the German colonists demanded an autonomous republic, but the Supreme Council, having regard to the wishes of the natives and to their well-being, gave the colony to the Union under a mandate.

For a time the Union found it difficult to unite the different racial elements, namely, Boers, Germans, British, and natives, but this was accomplished in time to oppose an impenetrable front to the Bondelzwarts, a small offshoot of the Hottentots, about 2000 in number, who, during 1921, refused to pay dog-tax and imprisoned the police officers engaged in its collection. Operations, carried on largely by air, lasted until June, 1922, when Abraham Morris, the rebel leader, was killed.

BIBLIOGRAPHY: H. Tönnesen, *The South-West Africa Protectorate* (in *Geographical Journal*, vol. xlix, No. 4, April, 1917); articles in *Meyer's Konversations Lexicon*, and the yearly supplements treat the subject from the German standpoint. The work is in the German language. (See especially article *Herero*, with map, in vol. ix.) *South-West Africa: Peace Handbook No. 112* (H.M. Stationery Office); P. A. Wagner, *The Geology and Mineral Industry of South-West Africa* (a Union of South Africa Government publication, with a comprehensive bibliography).

Sovereign, a gold coin, the standard of the English coinage. It exchanges for twenty shillings sterling, and has a standard weight of 123·274 grains, being of 22 carats fineness, and coined at the rate of 1869 sovereigns from 40 lb. troy of gold.

Soviet, Russian word meaning council, and denoting the method of government adopted by the Bolsheviks. It is based upon the idea of a series of local elective bodies sending delegates to larger bodies, and these, in their turn, to the Supreme Congress, which elects the Supreme Council. Thus the primary assembly, council, or soviet of all the workers in a particular factory, or of all the agricultural workers or peasants in a particular village, send representatives to higher soviets. Every six months the city and provincial soviets send delegates to the All-Russia Congress of Soviets, and this Congress elects a Central Executive Committee of 250 members, which again elects the Cabinet or the Council of the People's Commissaries. The Central Executive Committee is nominally the supreme power in the interval between the meetings of the All-Russia Congress. Sovietism, however, must not be identified with bolshevism, and although the Bolsheviki have adopted the soviet method of government, sovietism is neither synonymous nor is it even connected with bolshevism or communism. Honestly worked, in an intelligent and educated people, by men desiring only the common weal, the system would have certain merits (Viscount Bryce, *Modern Democracies*, ii, 584). The drawback of the soviet system lies in the fact that, in spite of its being eminently democratic, majorities can easily be obtained by an oligarchy in control. The electorate, too, is removed by several degrees from the highest officials. As the Russian masses are still far from being educated, and as the Bolshevik leaders certainly do not desire the common welfare of the country, the result of soviet government in Russia is a bureaucracy much worse than that which existed under the Tsars. The idea of a House of Trades was suggested in England in the early part of the nineteenth century, and the soviet system has been approved by the Socialist Labour Party.

---

[1] The adjacent islands, viz. Roastbeef, Plumpudding, Pomona, Possession, Long, Halifax, Albatross, all south of Angra Pequena; Seal and Penguin Islands, in the Bay; and Mercury, Hollam's Bird, and Ichaboe north of the Bay, were already British, having been annexed in 1867 and attached to the Cape in 1874. They are valuable, Ichaboe especially so, on account of their guano deposits.

Sowerby, an urban district of England, in the West Riding of Yorkshire, about 4 miles from Halifax. Pop. 4000.

Sowerby Bridge, an urban district of England, in the West Riding of Yorkshire, on the Rochdale Canal and the River Calder, and the Lancashire & Yorkshire Railway. Cottons, woollens, chemicals, and engineering products are manufactured. Pop. 11,500.

Sowing. See *Drilling*.

Sow-thistle, the name given to British species of a genus of composite plants (Sonchus). There are about fifty species, mostly herbaceous, but some forming shrubs or small trees. Some of the first may be considered cosmopolitan, while the woody sorts are almost restricted to the Canaries and the Island of Madeira. The most common species in Great Britain is the common sow-thistle (*Sonchus oleraceus*). It is very abundant as a weed, is greedily fed upon by many animals, and is sometimes used on the European continent as a pot-herb. It grows to a height of 2 or 3 feet, with a branching stem and small yellow flowers. The *S. mulgedium alpīnus* forms a tall and fine plant, with fresh and sharply defined foliage, and large heads of beautiful blue flowers. It is found in the mountains of Scotland as well as in Switzerland.

Spa, a town of Belgium, in the province of Liége. Its chief importance is due to its effervescent, chalybeate, saline mineral-waters, which are used on the spot and bottled for export. It has enjoyed a long celebrity, and has given its name to many mineral-springs. During the European War the Germans occupied the town (Aug., 1914), and it became a hospital base. In March, 1918, it became the head-quarters of the German High Command, and it was from the Château du Neubois near by that the Kaiser fled to Holland (8th Nov., 1918). Spa was the scene of a meeting of the Supreme Council in July, 1920.

Spadix, in botany, a form of the inflorescence of plants, in which the flowers are closely arranged round a fleshy peduncle, and the whole surrounded by a large leaf or bract called a spathe, as in palms and arums.

Spagnoletto (spȧn-yo-let′tō; 'little Spaniard'), a celebrated painter, whose true name was Giuseppe Ribera, or Ribeira, born 1588, died 1656. He was at first pupil of Caravaggio, but afterwards improved himself by the study of the works of Raphael and Correggio, at Rome and Parma. Ribera excelled in the representation of terrible scenes, as, for example, *The Flaying of St. Bartholomew*. He is represented in the galleries of Paris, Vienna, Naples, and Dresden.

Spahi (Turk.-Pers. *sipāhī*, i.e. sepoy). (1) Originally feudatories in Central Asia who yielded service to their feudal superiors. (2) In course of time the name was applied to the feudal soldiery supplied by these chiefs. (3) In Turkey the Spahis were a body of irregular cavalry organized by Murad I (1359–89), and formed the core of the Turkish cavalry. They were replaced by regular cavalry during von Moltke's reorganization in 1835. (4) A French group of native Tunisian, Algerian, and West African cavalry, under French officership, and organized and armed on the same basis as regular French cavalry.

Spain (Sp. *España*), a state in the south-west of Europe, forming with Portugal the great south-western (Iberian) peninsula of Europe. It is separated from France on the north-east by the chain of the Pyrenees, and is otherwise bounded by Portugal and the Atlantic and Mediterranean. Area, 194,783 sq. miles (190,050 sq. miles if the Canary and Balearic Islands be excluded).

Colonies.	Area, sq. Miles.	Pop.
Africa—		
Rio de Oro and Adrar	109,200	495
Ifni	970	20,000
Guinea	9,465	200,000
Fernando Po, Annobon, Corisco	—	—
Gt. Elobey, Lit. Elobey	814	23,845
Zone of Morocco	7,700	600,000
Total	128,149	844,340

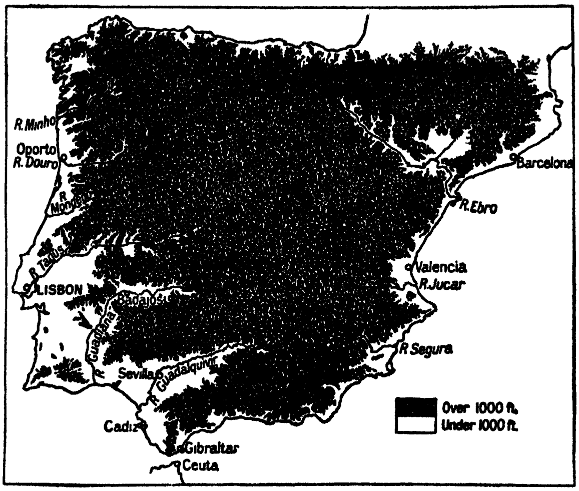
The Canary Islands form an administrative part of Spain, and these, with the Balearic Islands, are excluded from the total of 190,050 sq. miles representing continental Spain.

There are forty-nine provinces with an estimated population of 20,784,000, which is approximately a density of 107 inhabitants per square mile. Formerly the administrative divisions were New Castile, Old Castile, Leon, Asturias, Murcia, Valencia, Galicia, Estremadura, Andalusia, Aragon, Catalonia, Navarra, and the Basque Provinces. Madrid is the capital; other towns are: Barcelona (pop. 1922, approximately 583,000), Valencia (240,000), Sevilla (150,700), Malaga (137,000), Murcia (124,000), Zaragozá (Saragossa, 118,000), and Cartagena (103,000).

Physical. — The mass of the area consists of the *meseta*, a great plateau region crossed by mountain ranges trending from south-west to north-east. It rises abruptly from the sea, and has a higher and a lower region roughly corresponding to Old and New Castile respectively. The Ebro and Guadalquivir valleys and the narrow, coastal plain on the Mediterranean are very productive. The climate is very dry, and there are great extremes of temperature, both annual and daily. There is a good rainfall in the north, however, and the population is more dense there than elsewhere.

Production.—*Agriculture* is of primary importance, and the variability in climate is reflected in the extraordinary variation in the produce. Generally, however, the coastal plain produces fruit and timber, and the plateau (especially in Old Castile, where wheat predominates) yields grain. Nearly 25 per cent of the people are devoted to agriculture, 0·25 per cent to hunting and fishing, 0·42 per cent to mining, 5·0 per cent to manufacture, and 0·7 per cent to transport services. About 89 per cent of the continental area of Spain is productive: 36 per cent is used agriculturally, 2·5 per cent by viticulture, 22 per cent by fruits, and over 25 per cent is laid down to natural grass. *Minerals* include: copper (provinces of Sevilla, Cordóba, and Huelva), iron (Vizcaya, Santander, Oviedo, Navarra, Huelva, and Sevilla), coal (Oviedo, Leon, Gerona, Cordóba, and Valencia), zinc (Santander, Murcia, Guipúzcoa, and Vizcaya), cobalt (Oviedo), manganese (Oviedo, Guadaljara), lead (Murcia, Jaen, and Almeria), salt (Guadaljara), sodium sulphate (Burgos), mercury (Ciudad Real and Oviedo), sulphur (Murcia and Almeria), and phosphorus (Cáceres and Huelva). Much anthracite, coal, lignite, asphalt, tin, silver, argentiferous lead, and wolfram are worked. *Fisheries* employ over 25,000 boats and 100,000 men—cod, sardines, and tunny being the chief catch. Many factories exist for canning sardines, &c. *Manufactures* include wines (sherry, malaga, &c.), and cane- and beet-sugar. Industrial development is not great except in Catalonia, especially Barcelona. Cotton textiles are very important; cork, paper, and glass are typical products.

Communications.—There is a large shipping trade, centred chiefly at Barcelona and Bilbao. Internal communication is maintained over 46,000 miles of road and 9500 miles of privately-owned railways. The chief railways are respectively those at the eastern and western ends of the Pyrenæan frontier-line, which are continued to Paris via Orléans (see *Systems, Railway*). The eastern line runs from Portbou to Empalme, where the line bifurcates, one running inland, and the other following the coast; but both of them meet at Barcelona. From Paris to Barcelona is 752 miles; Barcelona is 342 miles by rail from Marseilles. In the west the Spanish Northern Railway from Irun connects with Alsasua via San Sebastian; thence to Vittoria



Sketch Map of the Iberian Peninsula

and across the Ebro valley to Miranda to meet the Castejon-Bilbao line (155 miles); across the province of Burgos, via Burgos, and over the Pisuerga River below Torquemada to Venta de Baños, the junction for Santander (148 miles) and Corunna (347 miles), both via Valencia. From Venta de Baños southwards, the line runs along the Pisuerga valley to Valladolid, and then to Medina del Campo (for Salamanca, 48 miles), Arévalo, Avila, El Escorial, and Madrid, a total distance of 392 miles by through train from Irun. From Paris to Madrid is 903½ miles by rail.

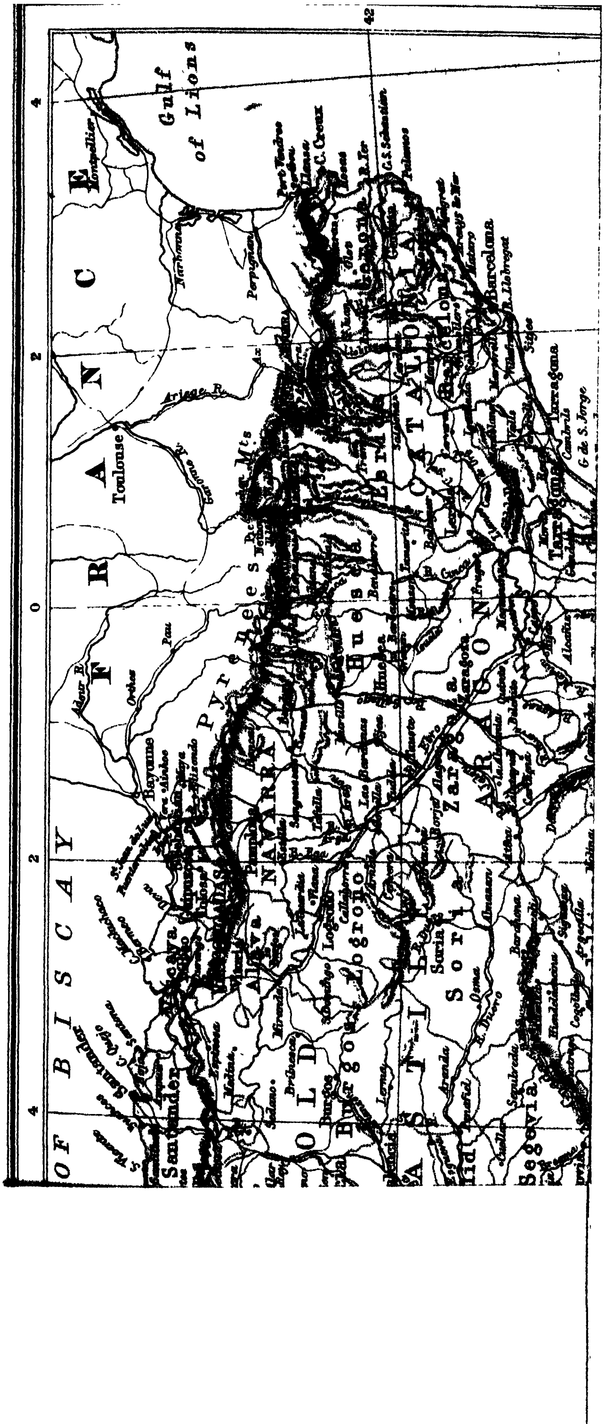
Government, &c.—The present Constitution dates from 1876, and enacts that the government be a Constitutional Monarchy, the legislative power resting 'in the Cortes with the King', the executive being vested, under the monarch, in a Council of nine ministers. The Cortes is bicameral, comprising Senate (Senado) and Congress (Congreso) of equivalent authority; the former consists of 360 members, one-half of whom are elected by corporations and similar bodies, the other half being life Senators nominated by the Crown, and 'Senators by their own right' (*Senadores por derecho propio*). The Congress is formed by Deputies, one elected by each 50,000 inhabitants, and taking office for five years. The various provinces, districts, and communes are governed by their own municipal laws with local administration. Each commune has its affairs directed by an elected *ayuntamiento*, and each province has its *diputación provincial*, or Parliament, whose members are elected by the *ayuntamiento*.

Army and Navy.—The army consists of (1) a permanent army, in which all above the age of twenty are liable to serve for three years, with a preliminary period of one year 'in depot'; (2) an active reserve with five years' service; (3) a six years' reserve; and (4) an unorganized two years' territorial reserve. There are eight military territories, each under a captain-general. Six territories supply two divisions each to the army in the field; the remaining two send one each. Each division comprises two infantry brigades of two three-battalion regiments, a cavalry regiment, and one six-battery regiment of mobile artillery with four guns to a battery. There are engineer regiments, six of sappers and one each of railways and telegraphy. The aviation headquarters are at Guadaljara. The total strength is roughly 300,000 men. The Mauser rifle (1893 model), ·275 calibre, is the infantry model; cavalry are equipped with the Mauser carbine; the field-artillery use the Schneider Canet, 14½-pounder. The navy comprises three battleships, six cruisers, and a miscellany of smaller craft.

People.—The people of Spain are of very mixed origin, the most ancient inhabitants, the Iberians (now represented probably by the Basques or Biscayans of the north-east), being afterwards mingled with Celts, Phœnicians, and Carthaginians, Roman colonists, Goths, Jews, and Arabs or Moors. Under the Constitution, the State binds itself to maintain the Roman Catholic Church, whose power is very great; in a struggle between the Church and the army it is said that the former would certainly win. There are nine archbishops, the Archbishop of Toledo being primate. Religious communities must be officially registered. They are over 3000 in number. In 1857 an elaborate scheme of education (including compulsion) was proclaimed by the Government, but never enforced; and education is in a backward state. Recently, however, there has been an educational 'revival'. There are eleven universities: Barcelona, Granada, Madrid, Murcia, Oviedo, Salamanca, Santiago, Sevilla, Valencia, Valladolid, and Zaragozá (Saragossa).

History.—The most ancient known inhabitants of Spain were the Iberians (see *Iberia*). To these afterwards were joined certain tribes of Celts, and subsequently the two races united. The Phœnicians early founded coastal trading colonies, chiefly at *Gadeira* (Cadiz) about 1100 B.C. The Greeks subsequently founded several cities, and then (238 B.C.) the history of Spain may properly be said to begin with the Carthaginian invasion. Hamilcar Barca undertook to subjugate the Celtiberian tribes of the Peninsula and in this work he was followed by Hasdrubal and Hannibal. In the course of the second Punic War the Romans arrived in Spain, and (205 B.C.) drove out the Carthaginians, whereupon the land became a Roman province, and was, through time, almost completely latinized.

At the fall of the Western Roman Empire, the province of Spain was conquered by the Visigoths (about A.D. 418), under whose vigorous kings Spain became the most flourishing of Teutonic kingdoms; but, at the beginning of the eighth century, they fell before the rapid conquests of the Arabs, and the Christian Goths sought refuge in the mountains of Asturias and Castile (q.v.). (See *Goths*; *Roderick*.) For some years Spain was a dependency of the Saracenic province of North Africa, but eventually an independent dynasty was established (A.D. 756) by Abd-al-Rahman at Cordova (q.v.), and was aggrandized by Hisham (788) and his son Al Hakam (796). Culturally, the Moors were far in advance of the Goths; they built magnificent cities and founded universities, and the golden age of Arab literature was reached in the reign of Abd-al-Rahman III (912–961). In religious tolerance also the Moors were far in advance of the age, permitting the forms of worship approved by the Christians, and even allowing



OF BISCAY
F R A N C E
Gulf of Lions
Montpellier
Narbonne
Perpignan
Port Vendres
C. Creux
Toulouse
Ariege R.
Ax
Pau
Orthez
Adour R.
Bayonne
Pyrenees Mts
NAVARRA
Pamplona
Huesca
Lerida
Gerona
CATALONIA
Barcelona
B. Llobregat
Sitges
Tarragona
G. de S. Jorge
Zaragoza
ARAGON
Logroño
Soria
Burgos
Santander
Santoña
Castro Urdiales
Bilbao
Miranda
Lerma
Aranda
R. Duero
Osma
Segovia
42
4
2
0

intermarriage. Meanwhile the descendants of the Visigoths had formed the kingdoms of Leon, Portugal, Castile, Navarra, and Aragon in the submontane districts of the north, and the subsequent history of Spain is chiefly the story of the expansion and union of these states under the hegemony of Castile and Aragon. The rise of these two powerful Christian states in the eleventh century was contemporary with the decline and disruption of the Ommiad Muslim dynasty. However, it took four centuries to drive the Moors out of Spain. The Holy War began in the eleventh century with the rising of the Zealots, and ended in 1492 with the conquest of Granada by Ferdinand and Isabella (q.v.). (See *Almoravides*; *Almohades.*)

By the marriage (1469) of Isabella, the heir to the crown of Castile, with Ferdinand of Aragon, begins the modern history of Spain. The two states thus united retained their own laws, customs, and administration, but their gradual fusion was promoted and largely accomplished by Cardinal Ximenes. To strengthen the Central Government and curtail the power of the nobility, the *Santa Hermandad*, or Holy Brotherhood, was formed (1476) to act as the administrators of justice; the Inquisition (q.v.) was instituted (1481) to promote religious orthodoxy and unity, and the Jews were expelled for heterodoxy. In 1492 Columbus (q.v.) discovered the West Indies, and laid the foundations of Spanish greatness overseas.

When Ferdinand died in 1516, his daughter Joanna, who had married Philip, son of the Emperor Maximilian I, succeeded to the Kingdom of Aragon, but her son, Charles I, became king of the whole of Spain (1516) and (as Charles V) of Naples, Sicily, Sardinia, Austria, and the Netherlands, and Holy Roman Emperor.[1] The conquest of Mexico (1518) and Peru (1531) belong to the reign of Charles, who retired to a monastery and was succeeded by his son, Philip II (1556–98).

The destruction of the Invincible Armada was an event in the reign of Philip II (q.v.). He was succeeded (1598) by Philip III, who, by expelling all the Moriscos from his kingdom and engaging in the Thirty Years' War (q.v.), further impoverished the country. Disaster again overtook Spain on the accession of Philip IV (1621), whose haughty centralizing policy under the minister Olivarez brought about civil war in Catalonia, Andalusia, and Naples; the loss of Portugal and French-Comté; and the independence of the Netherlands (see *Portugal*; *Netherlands*, *History* sections). Under his son, Charles II (1665), a prince who was feeble both in mind and body, the country declined still more, and at his death in 1700 without an heir, there began the War of the Spanish Succession. The succession to the throne lay between the Habsburgs, whose claim was upheld by the Emperor Leopold I, and the Bourbons, whose claim was maintained by Louis XIV. After a prolonged European war, it was agreed by the Treaty of Utrecht (1713) to acknowledge the Bourbon Philip V (q.v.) as King of Spain, on condition that the Netherlands and the Italian provinces were given to Austria, while England claimed Gibraltar and Minorca (see *Sicily, History*).

Under the able administration of Cardinal Alberoni (q.v.), Spain now regained a large part of its power in Europe. This revival was continued under Ferdinand VI, who succeeded to the throne in 1746; but it received its greatest impulse from Charles III (1759), who developed the agricultural and other resources of his country, and broke the power of the Inquisition (1767).

The full effect of these and other liberal measures was arrested, however, by the accession of Charles IV (1788), whose policy, directed by Godoy (q.v.), first brought about a rupture with the French Republic, and then a close alliance with France and a war against the British, resulting in the battle of Trafalgar (1805), when the naval power of Spain was again destroyed. Spain received further humiliation by the success of Napoleon, the Treaty of Fontainebleau, and the occupation of the country by a French army (see *Peninsular War*). In the spring of 1813 Wellington (q.v.) was able to clear the Peninsula of French troops, and, as a consequence, the Bourbon prince, Ferdinand VII, returned and was proclaimed king (1814).

The Colonial Empire.—Spain was one of the earliest of colonizing nations, and had hardly become united under Ferdinand and Isabella when she began an era of foreign conquest. Within sixty years of the first discoveries of Columbus, Spain had founded, and was in active process of developing and exploiting, an enormous colonial empire in the New World, mainly in South and Central America and the West Indies. The Spaniards did not settle thinly populated and poor lands, but conquered by the sword the rich and powerful nations, such as the Aztecs of Mexico and the Incas of Peru. However, the sixteenth century saw the high-water mark of Spanish colonial glory; the adventurous and crusading motives of the men who accompanied Hernando Cortez and Francesco Pizzaro became replaced by greed, and to pay for the extravagance of Spain at home, overseas Spain became merely rich estates which sweated and toiled. A vicious commercial exclusiveness was practised which debarred certain classes of Spaniard, and all foreigners, from trading with the Spanish colonies, and a fairly methodical administration, and the exercise of humanity towards slaves, were completely marred by the introduction of that religious intolerance and political despotism which wrecked Spain at home. The Spanish colonial empire fell to decay; the various American provinces became independent republics, and many of the last vestiges, such as the Philippines, or Cuba, were ceded to the United States after the disastrous Spanish-American War. (See Table in geographical section of this article.)

During the Napoleonic wars the South American colonies had asserted their independence,

---

[1] Cf. *Holy Roman Empire: Charles V: Naples.* The greatness of Spain at home was due, not to conquest, but to a fortunate series of marriage alliances by which more than half of Western Europe fell under the sway of Charles V.

Florida had been sold to the United States, and the finances misused; while these things were now aggravated by the despotic rule of a king who dissolved the Cortes, set aside the Constitution, and re-established the Inquisition. A revolt against this policy took place in 1820 and spread throughout the country, in consequence of which the Constitution was re-established, the Inquisition abolished, and (1822) a Cortes with a Liberal majority elected. This movement for liberty, however, was suppressed by the Holy Alliance (q.v.), under whose sanction a French army entered Spain (1823) and remained there for four years, during which the royal absolutism was restored. In 1829 Ferdinand abolished the Salic law by a 'pragmatic sanction', and, as the result of this, his daughter was proclaimed queen, on the death of her father in 1833, under the title of Isabella II (q.v.).

As this queen was only three years old, her mother, Maria Christina, undertook the regency; but she was opposed by Don Carlos, a brother of the late king, and a serious civil war broke out. (See *Carlos de Bourbon.*) The Carlist party achieved considerable success at first, but the civil strife was ultimately brought to an end (1840) by the exile of the queen-mother and the appointment of Baldomero Espartero (q.v.) as regent. In 1843 the young queen was declared of age, and her government was carried on by Narvaez (q.v.), who had superseded Espartero. Real power, however, was in the hands of General Leopold O'Donnell, an Irishman, and Spanish politics of this period consisted solely of rivalry between O'Donnell and Narvaez. By the influence of Louis Philippe, the French king, a very unhappy marriage was completed in 1845 between Isabella and her cousin, Don Francisco d'Assisi. For some years after this event the political history of Spain became a medley of party intrigue and petty political change, until in 1866 the severe measures taken against the Liberals by Narvaez ended in a military insurrection. This, however, was suppressed by the royal troops, and Generals Prim, Serrano, and O'Donnell were banished.

More successful was the revolution of 1868, headed by Generals Prim and Serrano. The latter entered Madrid in command of the revolutionary troops, and Isabella fled to France. The Cortes still declared in favour of the monarchical form of government, and great difficulty was experienced in finding a prince both able and willing to occupy the vacant throne. It was offered to Leopold of Hohenzollern-Sigmaringen, but the jealousy of France caused Napoleon III to demand the withdrawal of this candidate, and the diplomatic difficulties connected with this matter were the ostensible cause of the Franco-German War (q.v.). After Sedan and the downfall of Napoleon III, the crown was accepted by Amadeo of Savoy, second son of Victor Emmanuel of Italy, and in 1870 he was formally elected king by the Cortes. But the various parties, among which the most active were the Carlists and the Federalists, made government difficult, and the king abdicated (1873).

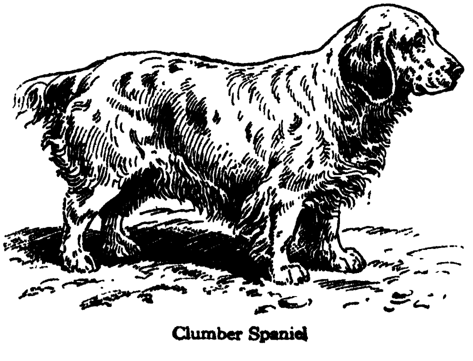
Following this event, the Cortes declared in favour of a Federal Republic, and the presidency was entrusted to Castelar (q.v.); but the course of events made this form of government impossible. Accordingly Castelar and his ministry resigned (1874), and the government of the country was undertaken by the chiefs of the Revolution of 1868, headed by Marshal Serrano; Under this military administration vigorous measures were taken to suppress the Carlist rebellion, and the throne was offered (1874) to the son of the exiled Isabella (see *Alphonso*). In 1875 the young king, with the title of Alphonso XII, landed at Barcelona, and successfully established his government. Alphonso XII died in 1885, and was succeeded by his daughter Maria, but the kingdom passed to his son on his birth in May, 1886. This son, known as Alphonso XIII, took up the reins of government in 1902 from his mother, Maria Christina, who had acted as regent. In May, 1906, he married Princess Victoria Ena of Battenberg, a niece of King Edward VII. The war of 1898 with the United States resulted in the loss of Cuba, Porto Rico, and the Philippines. In 1910 an Act was passed prohibiting the further settlement of religious houses in Spain. At the outbreak of the European War there was an undercurrent of public opinion favourable to the cause of the Allies, but the Dato and Romanones Governments declared for and maintained an absolute neutrality.—BIBLIOGRAPHY: Clarke H. Butler, *Modern Spain, 1815–1898* (Cambridge Historical Series); *Peace Handbook No. 34: Spain since 1815* (H.M. Stationery Office); Stanley Lane-Poole, *The Moors in Spain* (Story of the Nations Series); H. E. Watts, *Spain* (Story of the Nations Series); J. A. Froude, *English Seamen in the Sixteenth Century* (deals with Spanish sea-power and the Armada), and *The Spanish Story of the Armada*; C. E. Chapman, *A History of Spain.*

Language and Literature.—The Spanish language, which is also the language of Mexico and a great part of South America, belongs to the group known as the Romance or Romanic languages. Its formation was influenced by the lengthened duration in Spain of Roman institutions, by the Teutonic element introduced by the Visigoths, and by words of Arabic origin added during the long occupation of the country by the Moors. A number of different dialects developed themselves at an early date, such as the Galician, Catalan, Asturian, &c., but the Castilian took the lead, and came to be considered as the standard of Spanish. The Castilian idiom, which originated in the mountains of the interior of Spain, is characterized by deep and open tones, which now distinguish the Spanish from the Portuguese. The national literature of Spain dates from the twelfth century, ballads and metrical romances being its earliest products. To this period the *Pocma del Cid* is usually ascribed, an epic in which are narrated the adventures of Rodrigo Diaz de Bivar, the national hero. Following this early historical and legendary theme came the didactic verse of the Benedictine monk Gonzalo Berceo (1198–1268). To the same period belong two lengthy narrative poems on Alexander the Great and Apollonius of Tyre, both of which are written in single-rhyme quatrains. But perhaps the most remarkable piece of writing of this age was *Las Siete Partidas* (1265), a Castilian code of laws published under the patronage of Alphonso X; and to this was added the *Libros de Astronomia* and the *Lapidaria*. The most notable of the Spanish poets of the fourteenth century was Juan Ruiz, arch-priest of Hita (1300–51), whose tales, interspersed with songs (*cantigas*), deal with the vices of his countrymen. Of the same burlesque character were the *Rimado de Palacio* of Pedro Lopez de Ayala (q.v.), the *Proverbios Morales* of Santob the Jew, and a version of the *Dance of Death*. To this century belong the *Crónica de España*, compiled by order of Juan Fernandez de Heredia; and the authors of the prose chronicles of this period include: Pedro de Ayala, Fernan de Guzman, Alfonso de Palencia, Fernando del Pulgar, and Andrès Bernaldes. Along with these historical chronicles may be mentioned the biographies of Pedro Nino, Álvara de Luna, Gonzalvo de Córdova, and Ruy Gonsalez de Clavijo. In the sixteenth century there was published the *Amadis de Gaula*, the first of the Spanish *caballerias*, or 'books of chivalry'; and allied to it in character, but published later, were the *Amadis de Grecia*, *Don Florisando*, *Don Florisel de Niquea*, &c. At the court of Juan II (1406–54), in Castile, the 'gaya ciencia' of the troubadours was established by Enrique, Marqués de Villena, who was himself a translator of Virgil, and whose pupil, Lope de Mendoza, Marqués de Santillana, wrote numerous sonnets and *serranillas*. It was not, however, until the Kingdoms of Castile and Aragon were united under Ferdinand and Isabella that Spanish literature attained its chief distinction. This classic period, influenced by the Renaissance in Italy, found its first expression in numerous tercets, sonnets, and *canciones*, of which the principal writers were; Juan Boscan-Almogaver (q.v.), Diego de Mendoza (q.v.), Garcilaso de la Vega, Fernando de Herrera, and Hernando de Acuña. These innovators of the Petrarchian school were opposed by the rhymers of the old Castilian *redondillas*, chief among whom was Cristóbal de Castillejo (q.v.). But more characteristic of this period was the vigorous development of the *novela*, with a picaroon or rogue for hero (see *Picaresque Novel*). Yet these were all surpassed, and the chivalric extravagance of this period burlesqued to extinction by *Don Quixote* (first part 1605), the masterpiece of Miguel Cervantes de Saavedra (see *Cervantes*). The position in popular favour occupied by the romance was claimed at the end of the sixteenth and beginning of the seventeenth centuries by the drama. From beginnings in the mediæval mystery-plays it had developed through quasi-religious and wholly secular plays of an unimportant nature until the time of Lope de Vega (q.v.) (1562–1635). Among the chief imitators and successors of Lope were Velez de Guevara (q.v.), Gabriel Tellez (Tirso de Molina), and Juan Ruiz de Alarcón (q.v.). But this movement received its full perfection and refinement in the poetical and philosophical dramas of Pedro Calderón de la Barca (q.v.) (1600–81). He also had followers and imitators, among whom may be mentioned Moreto, Solis (q.v.), and Roxas de Castro. Among the historical writings of this era were the *Historia de España*, by Juan de Mariana; *Guerra de Granada*, by Diego de Mendoza (q.v.); the *Historia Verdadera de la Conquista de la Nueva España*, by Bernal Diaz del Castillo; and the *Historia de las Indias*, by Bartolomé de las Casas (see *Las Casas*). The mystics were represented by Avila, Santa Teresa, Ribadeneira, and Molina. With the decline in the greatness of the nation, however, there appeared a decadence in its literature. During the eighteenth century the drama lost all virility, while lyric poetry was largely represented by the artificial extravagances perpetuated by the imitators of Gongora (q.v.). But with the accession of the Bourbons there was introduced from France an element of revival into Spanish literature which was furthered by the *Poetica* of Ignacio de Luzan, the *Retorica* of Gregorio de Mayans, and the *Teatro Critico* of Benito Feyjoo. This French element had also its influence upon the poets of the latter half of the eighteenth and beginning of the nineteenth centuries, among whom were Valdes, Cienfuegos, Iriarte, Gonzales, Moratin, de la Rosa, &c.; while the romance was revived in the *Fray Gerundio* of José de Isla, who was also the translator of *Gil Blas*. The romantic movement of France had its Spanish adherents, among whom, as the most notable poets, are to be named Zorrilla, Espronceda, Diaz, Escosura, and Pacheco; the chief classicists being Quintana, Reinoso, Calderon, and Carvajal; while as a satirist José de Lara (Figaro), as a dramatist Manuel Breton de Herreros, and among historians Clavigero (q.v.) are worthy of mention. In more recent times the poets Ramon de Campoamor y Campsorori (1817–1901) and Nuñez de Arce (1834–1903); the authors Vicente Blasco Ibañez (1867), Luis Coloma (1851–1915), Ricardo Leon (1877), Salvador Rueda (1857), Juan Menendez Pidal (1861–1915); and the dramatist Jacinto Benavente (1866), who was awarded the Nobel prize for literature in 1922, have all attained distinction. —Bibliography: G. Ticknor, *History of Spanish Literature*; J. Fitzmaurice-Kelly, *History of Spanish Literature*; H. B. Clarke, *Spanish Literature: an Elementary Handbook.*

Spa′lato, a seaport of Yugo-Slavia, in Dalmatia, on a bay of the Adriatic, 80 miles south-east of Zara. The whole town was at one time confined within the precincts of the vast palace built by the Emperor Diocletian, and of which many impressive remains are extant. There are chemical-works, tanneries, soap-works, a bell-foundry, coppersmiths-shops, and manufactures of shipping-nets and cement. On Monte Marjan near by there is a sulphur-spring. Pop. 31,000.

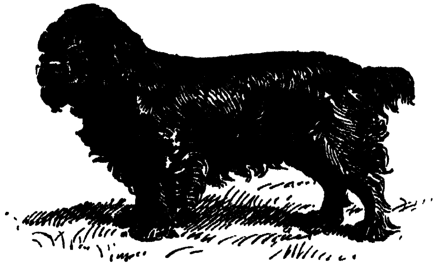
Spalding, an urban district and market town of Lincolnshire, England, on the Welland; served by the Great Northern Railway, &c. There is a grammar-school, founded in 1567, and a museum is housed in the remains of a Benedictine priory. Pop. 10,700.

Spandau, a town of Brandenburg, Prussia, at the confluence of the Spree and Havel. Before the European War, Spandau was a fortress of the first class, and formed an important part in the general defences of the capital. In the citadel, on an island in the Havel, is the Julius tower, where the imperial military reserve fund in gold was kept. The basis of this fund was the indemnity levied on France in 1871. Pop. 95,000.



Clumber Spaniel

Spaniel, the name of a race or variety of dogs. The English water-spaniel is now almost extinct. The Irish water-spaniel is a fine animal of a dark rich liver or puce colour, with a crisp curly coat and a well-marked top-knot, and the large, pendulous ears characteristic of the race. A useful sporting variety is the short-legged Clumber spaniel, mostly lemon-and-white in colour, with long, silky, abundant hair. The Sussex spaniel differs from the Clumber chiefly in its golden-liver colour. The black field spaniel is a good sporting dog. The chief kinds of *toy* spaniels, all more or less pug-faced, are the King Charles (black-and-tan), the Ruby (chestnut-red), the Blenheim (red-and-white), the Prince Charles (black, tan, and white), and the Japanese (black, red, or lemon on white). The Maltese dog is a kind of spaniel.



Black Cocker Spaniel

King Charles Spaniel

Spanish-broom, a plant of the genus Spartium, the *S. junceum*, allied to the common broom, but of more rush-like growth. It has been cultivated in British gardens for upwards of three hundred years, bearing handsome yellow flowers. A good fibre is obtained from the macerated twigs, which is made into thread, cord, and a coarse sort of cloth in some of the Mediterranean countries.

Spanish-brown, a species of earth used in painting, having a dark reddish-brown colour, which depends upon the sesquioxide of iron.

Spanish-elm, an evergreen tree of Mexico and the West Indies, yielding a tough elastic wood of a fine grain (*Cordia gerascanthus*).

Spanish Town, a town of Jamaica, British

West Indies, on the Cobre River; a junction on the insular railway. The insular system connects Kingston with Montego Bay (pop. 5000), a distance of 112·7 miles. Branches are thrown off (1) at Spanish Town, for Ewarton (17 miles); and (2) at Bogwalk, on the Ewarton line, for Port Antonio (pop. 2000), a distance of 54·2 miles. Spanish Town, founded in 1525 as Santiago de la Vega, was the island-capital until 1871, and has greatly declined. Pop. 7000.

Spar, in mineralogy, a term employed to include a great number of crystallized earthy, and some metallic substances, which easily break into fragments with glancing surfaces. Among miners the term spar is frequently used alone to express any bright crystalline substance.

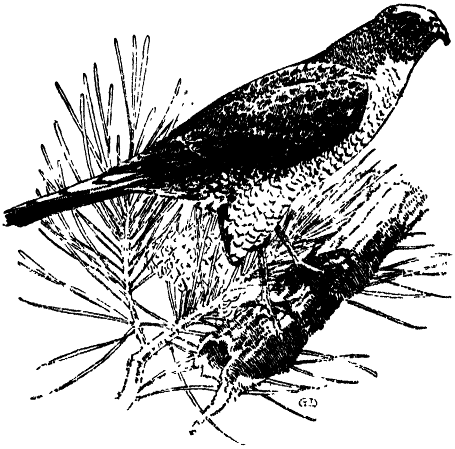
Spa'ridæ, a family of spiny-finned teleostean fishes, of which the genus Sparus is the type. They somewhat resemble the perches in form, the body being generally of an ovate form and covered with large scales. The Sparidæ are mostly inhabitants of warm climates. They are edible, and some of them highly esteemed. British examples are the gilthead (*Pagrus auratus*) and the sea-bream (*Pagellus centrodontus*).

Spark, Electric, the passage of electricity by a disruptive discharge through the insulating medium which separates two highly charged conductors. It is seen in the working of induction-coils and influence-machines, whilst lightning is the manifestation of the spark in nature. The spark causes chemical combination when passed through detonating mixtures of gases, such as chlorine and hydrogen; this effect is utilized in the sparking-plug to fire mixtures of petrol and air. When the spark is passed through moist air, it forms nitric acid, an effect employed in the Birkeland and Eyde method for the fixation of atmospheric nitrogen. The electric spark decomposes ammonia and olefiant gas. The potential difference required to cause a spark of given length depends on the presence of ions in the gas, and normally the spark takes place at a definite voltage known as the sparking potential. If there are few ions present, retardation of the spark takes place, and the applied voltage may exceed the sparking potential without the occurrence of a spark. On the other hand, the presence of an ionizing agent, such as ultra-violet light, assists the formation of a spark, and lowers the sparking potential. The minimum sparking potential in air is 340 volts. Up to a certain point, the sparking potential is lowered by reducing the pressure of the gas, but after the 'critical pressure' has been reached, further lowering of the pressure raises the sparking potential. Paschen concluded that the sparking potential was a function only of the sparking distance and the pressure of the gas.

Sparmannia, a genus of small African shrubs, order Tiliaceæ. *S. africana*, which has umbels of showy white flowers, is often grown in hot-houses. The large brick-red stamens are irritable, spreading quickly outwards when touched.

Sparrow (*Passer domesticus*), a well-known bird of the finch family which inhabits the British Islands and other parts of Europe, and has been introduced into North America and Australia. They often do great injury in corn-fields and gardens, but they also do great service in destroying grubs, caterpillars, &c. The tree sparrow (*P. montānus*), the only other British species, is also very widely distributed. It very closely resembles the common sparrow, but is of smaller size. For the hedge-sparrow, see *Hedge Warbler*. Some of the allied buntings are called 'sparrows' in America.

Sparrow-hawk, the common name of several hawks, one of which is well known in Britain, the *Accipiter nisus*, about 12 inches in length. The male is coloured dark-brown on the top of the head, and on the upper aspect of the body and wings. The under parts are of a reddish-brown colour, marked with narrow bands of darker tint. The female bird is of a duller brown hue on the back and head; and her plumage is diversified by numerous white spots. It is a bold, active bird, very destructive to pigeons and small birds. It ranges from Ireland to Japan, and occurs in North India and Egypt. Other species are native to South-Eastern Asia, the East Indies, Australia, and America.



Sparrow-hawk

Sparta, or **Lacedæmon** (now **Sparti**), a city of ancient Greece, the capital of Laconia and of the Spartan state, and the chief city in the Peloponnesus, lay in the Eurotas Valley, and embraced a circuit of 6 miles. Sparta was a scattered city, actually a union of five villages, and was always unwalled. Unlike Athens, it was plainly built, and had few notable public buildings; consequently there are no imposing ruins to be seen here as in Athens, and the modern Sparta is only a village of some 4000 inhabitants. *Laconia,* the district in which Sparta was situated, was the south-eastern division of the Peloponnesus, bounded on the west by Messenia, from which it was separated by the chain of Taÿgetus, on the north by Arcadia and Argolis, and on the east and south by the sea. The Eurotas (Basilipotamo, 'king of rivers') flows through a considerable valley and empties into the Gulf of Laconia. The Spartan state was founded, according to tradition, by Lacedæmon, son of Zeus. The most celebrated of its legendary kings was Menelaus. It is said to have been conquered by the Heraclidæ from Northern Greece about 1080 B.C., who established a dyarchy or double dynasty of two kings in Sparta. Apart from this legend, it is accepted as an historical fact that the Spartans were the descendants of the Dorians who invaded the Peloponnesus about that period, and that from an early period they followed a set of rigorous laws ascribed to Lycurgus. Shortly after their settlement in the Peloponnesus it is probable that the Spartans extended their sway over all the territory of Laconia, a portion of the inhabitants of which they reduced to the condition of slaves (Helots). They also waged war with the Messenians, the Arcadians, and the Argives, against whom they were so successful that before the close of the sixth century B.C. they were recognized as the leading people in all Greece. Early in the following century began the Persian wars, in which a rivalry grew up between Athens and Sparta. This rivalry led to the Peloponnesian War, in which Athens was humiliated and the old ascendancy of Sparta regained. (See *Greece.*) Soon after this the Spartans became involved in a war with Persia, by joining Cyrus the Younger in his rebellion against his brother Artaxerxes Mnemon (401), but Athens, Thebes, Corinth, and some of the Peloponnesian states took this opportunity to declare war against the Lacedæmonians. The latter defeated the Thebans at Coronea (394); but, on the other hand, the Athenian commander Conon gained a victory over the Spartan fleet at Cnidus. This war, known as the Bœotian or Corinthian War, lasted eight years, and increased the reputation and power of Athens. To break the alliance of Athens with Persia, Sparta (387 B.C.) concluded with the latter power the Peace of Antalcidas; and the designs of Sparta became apparent when she occupied, without provocation, the city of Thebes, and introduced an aristocratical constitution there. Pelopidas delivered Thebes, and the celebrated Theban War (378–363) followed, in which Sparta was much enfeebled. During the following century Sparta steadily declined, although one or two isolated attempts were made to restore its former greatness. The principal of these was made by Cleomenes (236–222), but his endeavours failed, because there were then scarcely 700 of Spartan descent, and the majority of these were in a state of beggary. With the rest of Greece, Sparta subsequently passed under the dominion of the Romans 146 B.C.).

The Spartans differed from the other Greeks in manners, customs, and constitution. Their kings (two of whom always reigned at once) ruled only through the popular will, acting as umpires in disputes, and commanding the army. The Spartans proper, that is, the descendants of the Dorians, occupying themselves with war and the chase, left all ordinary labour to the Helots, while the class known as Periœci (descendants of the ancient inhabitants of the country) engaged in commerce, navigation, and manufactures. The distinguishing traits of the Spartans were severity, resolution, and perseverance, but they were also accounted faithless and crafty. When a child was born, if it proved vigorous and sound, the State received it into the number of citizens, otherwise it was thrown into a cave on Mount Taÿgetus. To accustom the children to endure hunger, they gave them but little food; if they stood in need of more, they were obliged to steal it; and if discovered, they were severely punished. They wore no outer garment except in bad weather, no shoes at any time, and they were obliged to make their beds of rushes from the Eurotas. The principal object of attention during the periods of boyhood and youth was physical education, which consisted in running, leaping, throwing the discus, wrestling, boxing, the chase, &c. A singular custom was the flogging of boys on the annual festival of Artemis Orthia, for the purpose of inuring them to bear pain with firmness. Whoever uttered the least cry during the scourging, which was so severe as sometimes to prove fatal, was considered as disgraced, while he who bore it without shrinking was crowned. The Spartans were the only people of Greece who avowedly despised learning, and excluded it from the education of youth. The education of the Spartan girls was also different from that of the Greeks elsewhere, and included training in wrestling and running.—BIBLIOGRAPHY: Sir J. G. Frazer, *Pausanias*; W. M. Leake, *Travels in the Morea*; E. N. Gardiner, *Greek Athletic Sports and Festivals*; C. O. Müller, *The History and Antiquities of the Doric Race.*

Spar'tacus, a Thracian gladiator, the instigator and leader of a revolt of the slaves in Italy (the Servile War) in 73–71 B.C. Being made prisoner, Spartacus was sold as a slave, and placed in a gladiatorial school at Capua with other Thracian, German, and Gaulish slaves. There they formed a conspiracy, and seventy gladiators, including Spartacus, effected their escape; and, being joined by the disaffected slaves and peasantry of the neighbourhood, in a few months Spartacus found himself at the head of 100,000 men. Two consuls were now sent with armies against him, but Spartacus defeated them in succession and led his elated forces towards Rome. In this crisis Licinius Crassus, who was afterwards a triumvir, was placed at the head of the army, and managed to hem in the revolted slaves near Rhegium. Spartacus was defeated and slain in 71.

Spartacus, the name given to the extreme Socialist group in Germany. Spartacus (q.v.) was used as a pseudonym by the German Socialist leader Karl Liebknecht (1871–1919). After the German Revolution of 1918, when instead of a Socialist Republic, as they had expected, a democratic Republic was established, the Spartacus group, led by Liebknecht, Rosa Luxemburg, and Franz Mehring, took up arms against the new Government, with a view to establishing a Socialist Republic under the dictatorship of the proletariat. Risings took place, but, after some successes, the Spartacus forces were defeated by the Government forces, and both Karl Liebknecht and Rosa Luxemburg were killed.

Spasm, in medicine, an abnormal, sudden, and more or less violent contraction of one or more muscles or muscular fibres. Spasm is either *clonic* or *tonic*. In *clonic spasm* the muscles or muscular fibres contract and relax alternately in very quick succession, producing the appearance of agitation, as in epilepsy. In *tonic spasm* the muscles or muscular fibres contract in a steady and uniform manner, and remain contracted for a comparatively long time, as in tetanus.

Spatan′gus, a genus of flattened sea-urchins, otherwise called ‘ heart-urchins ’ from their shape. The species are numerous.

Spathodea, a genus of trees, order Bignoniaceæ, natives of tropical Africa, with pinnate leaves and magnificent scarlet flowers. *S. campanulata* affords an excellent illustration of ‘ water calyx ’. From an early stage of development, the calyx is filled almost to bursting with a watery secretion, in which the rest of the floral organs are immersed until the flower actually opens. As the flowers are borne in tufts on the topmost branches, it has been suggested that the calyx acts as a water-bath, guarding the more valuable and delicate organs against overheating or desiccation. If the closed calyx be punctured with a needle, the liquid contents, being under pressure, are ejected through the hole with considerable force; for this reason some observers hold that the water-calyx serves to repel sharp-billed birds and other animals that might otherwise damage the buds. Neither of these explanations, however, accounts satisfactorily for other cases of water-calyx, which remains a somewhat mysterious phenomenon.

Spatularia, or **Polyodon**, a genus of fishes related to the sturgeons, and the type of a special family (Polyodontidæ). They are remarkable for the form of their snouts, which are enormously long and leaf-like in form. The only species is the paddle-fish or spoon-bill (*Polyodon folium*) of the Mississippi basin. A closely related Chinese form (*Psephurus gladius*) lives in the Yang-tse-kiang and Hoang-ho Rivers.

Spav′in, a disease of horses, affecting the hock-joint, or joint of the hind leg, between the knee and the fetlock. It occurs in two forms. In the first, which is called bog or blood spavin, the joint is distended by joint-oil (synovia). In the other form there is a morbid deposition of bony substance, such as to unite separate bones.

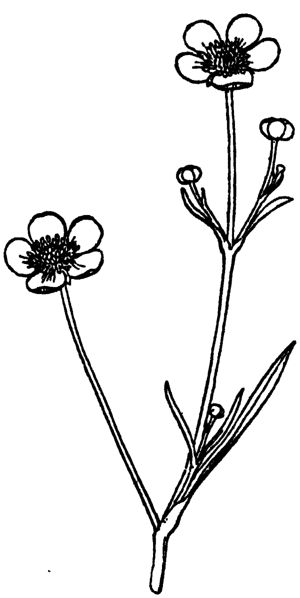
Spawn, the eggs or ova of fishes, frogs, &c., from which, when fertilized by the males, a new progeny arises that continues the species. In the oviparous bony fishes the eggs are usually impregnated externally, and arrive at maturity without the aid of the mother. The spawn being deposited by the female, the male then pours upon it the impregnating fluid. In sharks and rays fertilization is internal, and in some of these development takes place in the oviducts. Fishes exhibit a great variety in regard to the number of their eggs. In the spawn of a cod-fish, for example, no fewer than three and a half millions of eggs have been found. In general, before spawning, fishes forsake the deep water and approach the shore, and some fishes leave the salt water and ascend the rivers before spawning, and then return again. See *Reproduction*.

Speaker of the House of Commons, is the president of that assembly, occupying a position of great influence and taking precedence as the First Commoner of the Kingdom. He is chosen from among the members of the House immediately upon the meeting of a new Parliament, and his election is, through the Lord Chancellor, approved by the Crown at the bar of the House of Lords. The Speaker is not a member of the Government, does not take part in debates or vote in divisions, and maintains a strict impartiality. He is responsible for the maintenance of order, and from his ruling there is no appeal. On retirement he generally receives a peerage—usually a viscounty. In the House, the Speaker wears a black silk robe with train, and a full-bottomed wig; on State occasions the robe is of black damask, trimmed with gold lace. The official salary is £5000 a year.

Spearmint (*Mentha spicata*), a European and North American species of mint often cultivated for making sauce and in order to obtain a flavouring essence from it. See *Mint.*

Spear-thistle, a common British thistle, the *Cnicus lanceolatus.* It grows on waysides and in pastures. The leaves are downy beneath, and their points long and very sharp, and it has handsome heads of purple flowers.

Spearwort, a plant of the genus Ranuncŭlus. The great spearwort is the *R. Lingua*, and the lesser spearwort is the *R. flammula.* Both are British plants, with lanceolate undivided leaves and yellow flowers, growing in wet localities.


Lesser Spearwort
(*Ranunculus flammula*)

Special Constables, officers appointed to assist the regular police in times of emergency. Their appointment is chiefly regulated by an Act of 1831 (1 and 2 Will. IV, c. 41). They are enrolled at the instance of any two or more justices on occasions when it is deemed by them that the ordinary measures for the preservation of order are insufficient. Any citizen may be called upon to serve, and may be fined if he refuses.

Special constables have all the powers of the regular police. They have been appointed on several occasions, e.g. during the Reform riots, the Chartist demonstrations, and the European War. During the war they rendered valuable services in the guarding of places of importance, in observation work, and in patrol duty; and in 1919 these services were acknowledged by the issue of a special constabulary medal.

Under particular statutes special police are appointed to watch certain works in construction, harbours, salmon and freshwater fisheries, &c.

Species, as ordinarily defined, is any one group of animals or plants the members of which generally bear a close resemblance to each other in the more essential features of their organization, which produce fertile progeny, and which may, in the generality of cases, produce individuals varying from the general type of the group, the variation, however, being in all cases of a limited kind. Under this definition the various species, 'kinds' of animals and plants, and their included varieties, used to be comprehended, while naturalists regarded species as unchanging throughout the longest succession of ages, except within narrow and marked limits. Thus Buffon defines a species as "a constant succession of individuals similar to and capable of reproducing each other"; and Cuvier as "a succession of individuals which reproduces and perpetuates itself". Since the publication, however, of Darwin's *Origin of Species* this conception has been greatly modified by the view that, as Haeckel defines it, "the species is the whole succession of organisms which exhibit the same form in the same environment". In this conception no absolute standard of what constitutes a species can be set up, nor can the number of species, especially among the transitional varieties of the lowest forms of life, be determined. The best test of a species, though not infallible, is a physiological one. Related species may be fertile *inter se*, but the offspring—*hybrids*—are sterile. Related varieties or races, on the other hand, produce fertile *mongrels.* In scientific classification species unite to form groups called genera, which are included in orders, the orders forming classes, and so on. In mineralogy, chemistry, and such sciences as relate to inorganic substances, species is regarded by some writers as being determined by identity of physical properties, as specific gravity, hardness, &c.; and by others, as constituted by chemical composition, the physical properties going for nothing.—Species in logic is a group of individuals agreeing in common attributes and designated by a common name; a conception subordinated to another conception, called a genus or generic conception, from which it differs in containing or comprehending more attributes, and extending to fewer individuals; thus 'man' is a *species* under 'animal' as a *genus*, and 'man' in its turn may be regarded as a *genus* with respect to European, Asiatic, and the like.

Specific Gravity is the ratio of the weight of any body or substance to the weight of an equal volume of some other substance which is assumed as a standard of comparison. The density (q.v.) of a material being defined to be its mass per unit volume, its specific gravity is the ratio of its density to the density of the standard substance. The standard for solids and liquids is pure distilled water at an assigned temperature, most frequently 4° C. For gases the standard is air, or hydrogen. The specific gravity of a body depends more or less on its physical state and previous treatment. Rise of temperature, for example, causes the body to expand without altering its weight, and therefore diminishes its specific gravity; and the specific gravity of cast metal is increased by drawing, rolling, or hammering. In exact work, the temperature at which the determination is made should be taken into account. In the case of gases, this precaution is imperative, and the densities of gases are always reduced to normal temperature and pressure (N.T.P.), i.e. the temperature 0° C. and pressure 760 millimetres.

The chief practical methods for determining specific gravities are of two types: those depending on the application of the *Principle of Archimedes* (see *Hydrostatics*; *Hydrometer*; *Archimedes*), and those based on direct evaluation of the weight and volume of the specimen considered. Among methods of the latter sort, one of the most generally applicable is that which makes use of the *specific gravity bottle*, which is a thin glass flask with a capacity of perhaps 50 c. c., fitted with an accurately ground perforated stopper. To determine the specific gravity of a liquid, the bottle, after being thoroughly cleaned, is filled with distilled water, and brought to a definite temperature by immersion in a thermostat; the stopper is then inserted, and the bottle with its contents weighed. The process is repeated with the liquid under examination instead of water. The bottle is dried carefully before each weighing. The weight of the empty bottle being known, it may be subtracted from the weights as found, and the remainders are the weights of equal volumes of the liquid and of water, so that the specific gravity is found by dividing the one remainder by the other. The specific gravity of an insoluble solid substance, given in small fragments, or as a powder, may also be found with the help of the bottle.

Specific Heat. A definition of this phrase, with some explanatory remarks, will be found in the articles *Calorimetry*; *Heat*.

When referring to the specific heat of a gas, it is essential to state the relation between pressure and volume which holds while the heat is being added. Only two cases are of practical importance, the specific heat at constant pressure (C_p), and the specific heat at constant volume (C_v). In solids and liquids the difference between C_p and C_v is negligible. A gas, however, does work by its expansion when its temperature is raised at constant pressure. If Joule's Law holds (see *Gases, Properties of*), so that the change of internal energy depends only on the initial and final temperature, it follows that C_p must exceed C_v by the thermal equivalent of the work done during the expansion at constant pressure. The ratio of C_p to C_v, usually denoted by γ, is important both in theory and in practice. According to the Kinetic Theory of Gases, the value of C_p/C_v is $(n + 2)/n$, where n is the number of independent terms in the expression for the kinetic energy of a molecule. If the gas is monatomic, n is 3, for the molecular freedoms are three of translation; C_p/C_v ought therefore to be $5/3$ or 1·67. This has been verified experimentally for mercury-vapour, argon, helium, and other monatomic gases. Again, for $n = 5$, the expression $(n + 2)/n$ for C_p/C_v becomes 1·4, a value which is consistent with the experimental number for many gases having two atoms in each molecule, such as air, nitrogen, hydrogen, and oxygen; these gases must, on the Kinetic Theory, be supposed to have two degrees of molecular freedom more than monatomic gases.

A remarkable experimental law connecting the specific heat of a solid element with its atomic weight was discovered by Dulong and Petit in 1819. They observed that the *atomic heat*, or product of the specific heat and the atomic weight, had a value in the neighbourhood of 6·4 for many elements. The law has been found useful by chemists in making a choice between alternative values of an atomic weight. Three elements, carbon, boron, and silicon, were found to be exceptional, each of them having an atomic heat much lower than 6·4. For over a century the discrepancy remained unexplained. The specific heats of the early investigators were taken at ordinary temperatures, and it is only recently that values at extreme temperatures have become the subject of investigation. It is now known that specific heats vary greatly with temperature, the curve in which the atomic heat of a given element is plotted against temperature having a form which occurs in several branches of physics, rising gradually at first, then rapidly, and finally becoming nearly horizontal. For very low temperatures, the specific heat is very small. For very high temperatures, the atomic heats of carbon, boron, and silicon become comparable with those of other elements.

To explain these experimental results on theoretical grounds, Einstein and other physicists have recently made applications of Planck's idea of energy quanta (see *Quantum Theory*). The formulæ obtained give the atomic heat at constant volume in terms of the gas constant R (see *Gases, Properties of*), the quantum constant h, the absolute temperature T, and the frequency ν of an assumed atomic oscillator. Einstein's formula was found to give too low values at low temperatures, and an empirical modification of it was proposed by Nernst and Lindemann. A better formula still, agreeing very well indeed with experimental data, was given in 1912 by P. Debye, who attributes the heat energy of a solid to ordinary elastic vibra-

tions of all possible frequencies up to a certain maximum.

A few figures for specific heats at ordinary temperatures are given below. The numbers for gases refer to heating at constant pressure. It is interesting to note the comparatively high value for water, a point of importance in the economy of nature. The numbers for mercury and hydrogen are also worthy of special notice.

Solids.—Aluminium, 0·21; carbon (graphite), 0·16; carbon (diamond), 0·11; copper, 0·091; iron, 0·11; silver, 0·06; tin, 0·05.

Liquids.—Alcohol, 0·55; glycerine, 0·58; mercury, 0·033; water, 1·00.

Gases.—Air, 0·24; argon, 0·12; hydrogen, 3·4; nitric peroxide, 1·6; nitrogen, 0·24; oxygen, 0·24; steam, 0·49.

Spectacled Bear (*Ursus ornātus*), the sole representative of the bears in South America, inhabiting the high mountain forests of Chile and Peru. So called from the light-coloured rings round the eyes having exactly the appearance of a pair of spectacles, the rest of the face and body being black.

Spectacles, a well-known and invaluable optical instrument supposed to have been invented by Roger Bacon in the thirteenth century, and used to assist or correct some defect of vision. Spectacles consist generally of two oval or circular lenses mounted in a light metal frame, which is made up of the ' bows ', ' bridge ', and ' sides '. The lenses are usually bi-concave, bi-convex, or concavo-convex, though lenses forming segments of a cylinder are used in some cases of astigmatism. In long-sighted persons the defect of the eye is counteracted by convex lenses, in short-sighted persons by concave lenses (see *Vision*). *Divided spectacles* have each lens composed of two semicircles of different foci neatly united one above the other; one half for looking at distant objects, and the other for examining things near the eye. Another kind, called *periscopic spectacles*, has been contrived in order to allow considerable latitude of motion to the eyes without fatigue. The lenses employed in this case are either of a meniscus or concavo-convex form, the concave side being turned to the eye.

Spectra, Theory of. In suitable circumstances all elements and some compounds can be made to emit radiation which can be resolved into spectra consisting of a finite number of lines characteristic of the emitting substance. Similarly substances possess characteristic absorption spectra which appear as dark lines in the continuous spectrum of ' white ' radiation which has passed through the substance. The lines of spectra may lie in the visible, infra-red, or nearer ultra-violet regions (optical spectra), or in the distant ultra-violet (X-ray spectra); optical spectra may be further divided into line and band spectra, according to the distribution of the lines. These distinctions, though primarily experimental and incapable of accurate definition, are of great importance in the theory of spectra. The facts that are of greatest importance for such a theory can be grouped in the following classes: (1) The conditions in which spectra are excited; (2) the relation between emission and absorption spectra; (3) the connection between the spectrum of a substance and its other properties; (4) the change produced by magnetic and electric fields; (5) the relation between the frequencies of different lines in the same spectrum.

(1) In general, spectra are characteristic not of liquids and solids but of gases, i.e. of molecules (or atoms) free from mutual influence. Their emission is usually accompanied by the ionization of the emitting molecules, e.g. by chemical action in a flame, or by the impact of charged particles in the electric discharge, including that in an X-ray tube. The relative intensity of the lines, but not their frequency, can be varied to some extent by changing the conditions of ionization; in extreme cases some lines can be excited to the exclusion of others. Part at least of optical spectra can be excited without ionization by subjecting the molecules to the impact of electrons with sufficiently small energy or to light of suitable frequency; spectra excited by this last means are termed fluorescent. X-ray spectra, even when fluorescent, are inseparable from ionization.

(2) In the optical spectra of elements absorption lines are always emission lines, but the converse is not true; compounds may possess absorption spectra without emission spectra. In X-ray spectra the absorption lines are almost always of higher frequency than the neighbouring emission lines.

(3) Optical line spectra are generally characteristic of elements, band spectra of compounds, but there are some exceptions. The optical spectra of chemically similar elements resemble each other much more closely than those of dissimilar elements, but no general relation between such spectra and other properties has been found. X-ray spectra are all line spectra and all belong to elements; compounds give the spectra of their component elements. The X-ray spectra of all elements are closely similar, and to every line in one corresponds (within certain limits) a line in every other. The frequency of corresponding lines in the spectra of different elements is determined by the atomic number Z (see *Number, Atomic*), and is nearly proportional to Z^2 (Moseley's Law).

(4) When the emitting molecules are placed in a strong magnetic field (Zeeman effect) or

electric field (Stark-Lo Surdo effect), the lines of optical spectra are displaced and resolved into components in a manner which is complicated but orderly.

(5) The immense number of facts which have been brought to light since the discovery of the Balmer series in 1885 (see *Spectrum*) can be summarized in the following statements: (*a*) *Ritz's Principle of Combination.* The frequency of every line in a spectrum can be expressed as the difference between some pair of a group of numbers ('terms') which is characteristic of that spectrum; conversely, subject to a well-defined rule of selection, every difference between a pair of terms is the frequency of some line. (*b*) *Rydberg's Law.* In optical line spectra the terms can be divided into sub-groups ('series') such that the members of any one series are represented by $\frac{bN}{(m+a)^2}$, where N, very nearly the same for all elements, is about $8{\cdot}29 \times 10^{15}$ sec^{-1} (Rydberg's constant); and each of the positive integers in turn is put for *m*. *b* is usually 1, but is sometimes 4 and possibly sometimes 9; *a* is a constant (<1) characteristic of the particular element and of the particular series of that element. Rydberg's formula is not exact; for greater accuracy a small correction $\alpha\nu$, where ν is the term, should be added to *a* (Ritz's formula). (*c*) The lines of the more complicated spectra can be divided into *series* (to be distinguished from series of terms) such that each series is marked by some special characteristic. Thus we have the principal series (containing all the brightest lines), the sharp and the diffuse subordinate series, and so on. The lines in any one series tend to appear and disappear together (see (1) above). The frequencies of the members of a series of lines are obtained by subtracting from some one term all the members of some series of terms. For example, a series of lines may be represented by $\frac{N}{(1+a_1)^2} - \frac{N}{(m+a_2)^2}$, where *m* takes the values 1, 2, 3, . . . (*d*) In *band spectra* Ritz's principle probably applies, but Rydberg's Law does not. The terms are represented approximately by $A(m+a)^2$, where *m* has all integral values as before (Deslandres's Law). It should be mentioned that the more complicated spectra have not yet been analysed into Rydberg or Deslandres terms, but that there is little doubt that they will gradually be so analysed. (*e*) In X-ray spectra the largest terms are given approximately by $\frac{N(Z-z)^2}{m^2}$, where *z* is characteristic of the term but not of the element which gives the spectrum. The smaller terms are not given by any simple formula, but vary in a regular manner of which theory can give an adequate account.

The interpretation of these facts is due to Bohr (1913). Bohr regards each term of the spectrum as representing one of the quantum states (see *Quantum Theory*) of the atom (or molecule), so that if ν is the term, the energy of the corresponding quantum state is given by $W = h\nu$. The actual energy of the atom is (constant $-W$). The normal state of the atom, to which it reverts after any disturbance, is that for which W is greatest; it corresponds to the greatest term. In the optical spectrum the ionized state corresponds to the term 0, and all intermediate terms correspond to states in which one of the surface electrons of the atom is displaced from its normal position, but not wholly separated from the atom. The terms of the X-ray spectrum, on the other hand, correspond to states in which one or more of the internal electrons has been ejected to or beyond the surface of the atom; it is impossible that an internal electron should be displaced without being so ejected, because all the positions of an electron within the atom which are quantum states are normally occupied.

A line of the spectrum is emitted, according to this theory, when the atom passes from a quantum state of energy W_1 to another of energy W_2; the difference between these energies appears as energy of the radiation, and is related to the frequency ν of the line by the quantum equation $h\nu = W_2 - W_1$: it follows immediately that ν is the difference of the terms corresponding to the two states. Since a spontaneous passage between the two states will take place only if $W_2 > W_1$, i.e. if the change is in the direction of a return to the normal state, emission must always be preceded by a disturbance of the atom from its normal state (W_0), involving the expenditure of work. This work can be derived from the kinetic energy of electrons, or from incident radiation: in the latter case a line of the absorption spectrum appears in the transmitted light with a frequency given by $h\nu = W_0 - W_1$.

The theory is confirmed by experiment in many ways which do not involve a knowledge of the quantum states. Thus it is found that the energy required to ionize an atom is related to the greatest term of the optical spectrum in the way predicted, and that all absorption lines involve as one of their terms that corresponding to the normal state. But its successes are even more remarkable when combined with the general quantum theory which prescribes the quantum states. That theory determines the energies of these states and thus the terms of the spectrum. It requires that if the terms are expressed in the Rydberg form (which generally is only an approximation), the quantity bN should be equal to $\frac{2\pi^2e^2E^2m}{h^3}$, where e and m are the charge and effective mass of the disturbed electron, E the total charge on those parts of the atom which lie within its orbit. When $e = E$, the value of this expression, all the factors of which can be determined from experiments independent of spectra, accords exactly with the known value of Rydberg's constant. Hence b must be $\frac{E^2}{e^2}$. b is 1 for most optical spectra, because the atoms from which they are emitted are electrically neutral on the whole, and the charge on the part which lies inside the orbit of the disturbed surface electron (and includes all the atom except this electron) must be equal and opposite to that on the electron, i.e. $-e$. But some spectra are believed for independent reasons to be emitted by atoms from which one electron has already been removed completely by ionization; for such atoms E should be $-2e$, and b should be 4; this prediction is verified. In X-ray spectra, on the other hand, the disturbed electron may lie inside the atom and very near the nucleus, which carries a charge $-Ze$; accordingly b should be nearly equal to Z^2, as is found. a in Rydberg's formula cannot be deduced accurately from the theory, except when there is only one electron in the atom (hydrogen or ionized helium); but then theory and experiment agree in assigning to it the value 0. Further, the effective mass of the electron depends slightly on the mass of the nucleus; N should therefore not be exactly the same for all elements (even when b is the same). This prediction has also been confirmed, the variation of N being so small that it was not discovered till it was predicted theoretically. But small as the difference is, the great accuracy of spectroscopic measurements enables it to be determined with such precision that the difference between N for the hydrogen and helium spectra now provides an estimate of the mass of the helium atom more reliable than that derived from measurements of the density of the gas.

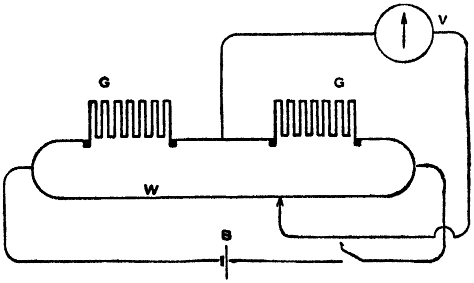
The theory is also successful in explaining the Zeeman and Stark effects by considering the changes which will be produced on the quantum states of the atom by an external magnetic or electric field. It also provides a very beautiful explanation of the resolution of apparently single spectral lines into several components when examined with the highest dispersion. The presence of these lines is due to the fact that, in accordance with 'relativity' mechanics, the mass of the electron varies slightly with its velocity, and the separation between them is found to be exactly that predicted by theory. In the X-ray spectra of the heaviest atoms the electrons are moving with great speed, and the resolution due to this cause becomes much greater; it is responsible for much of the complexity of X-ray spectra.

Bohr's theory has also been applied, but less completely, to band spectra. These are regarded as always emitted by polyatomic molecules, either chemical compounds or such elements as H_2 or N_2. Here the motion of the several massive nuclei relatively to each other has to be considered; part of the energy of the quantum states arises from the rotational energy of these nuclei. In accordance with experiment the terms representing this energy have the Deslandres rather than the Rydberg form. The examination of band spectra seems likely in the future to give as complete a knowledge of the construction of molecules as that obtained of the construction of atoms from the study of line spectra.

Finally, the theory has been extended to explain not only the frequency of spectral lines, but also their relative intensity. The principles on which such explanation can be based are sketched elsewhere (see *Quantum Theory*); here it must suffice to say that the Principle of Correspondence is likely to provide the clue. See *Matter*; *X-ray Spectra*.

Spectre-bats (Phyllostomatidæ), a family of insectivorous Chiroptera, which have a simple and fleshy leaf-like appendage to the nose, and a fore-finger of two joints. They attain to a considerable size, and the family comprises the vampire-bats (q.v.).

Spectro-bolometer, an apparatus designed and used by S. P. Langley, an American physicist, to measure heat radiation. Two grids of the same size are cut out of very thin platinum foil and placed, in an electrical circuit, in the opposite arms of a Wheatstone's bridge provided with a delicate galvanometer. When heat rays are allowed to fall on one grid, which is blackened to absorb the rays, the electrical balance of potentials at the ends of the galvanometer



Spectro-bolometer

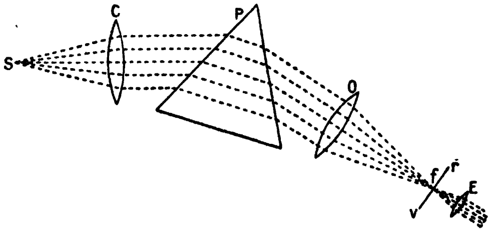
G, G, Grids. W, Bridge wire. B, Battery.
V, Galvanometer.

branch circuit is disturbed, and a current flows through the galvanometer, due to the increased resistance of the grid which receives the radiation. The observed deflection is a measure of the incident radiation.

To investigate the sun's spectrum, rays from the sun were passed, by means of a siderostat, into a special spectroscope, the collimator of which had a rock-salt lens. A spectrum was produced by a rock-salt prism, and the rays at a given part were focused on the bolometer grid. The deflection of the galvanometer mirror caused the spot of light to move across a photographic surface, and a system of clockwork rotated the prism and moved the sensitive surface in a vertical direction. As a result, the spectrum moved over the bolometer grid in two hours, giving a photographic record 2 metres long, which consisted of a wavy trace indicating the variations of the energy in the infra-red rays of the sun. The curves were affected by invisible clouds, and the height of the sun. Line spectra were made by an automatic process, and composite photographs of a number of these were made.

Spectro-heliograph, an instrument for photographing the sun by monochromatic light, designed by Professor G. E. Hale. The spectrum given by the light admitted through the slit of a spectroscope is made to fall upon a second slit, so that the light entering the second slit is transmitted and received upon a photographic plate, while all that of other wave-lengths is shut off. Either the spectroscope is kept fixed and the solar image and photographic plate caused to move in unison, or else the spectroscope with its slits is made to traverse the stationary image and plate. A representation of the sun in light of one wave-length is thus elaborated piece by piece. The sun's surroundings at different elevations can be separately investigated, and the form and size explored of clouds or *flocculi* of hydrogen, calcium, iron, &c. In particular, this instrument has revealed the circulatory or vortical motions existing in and around sunspots.

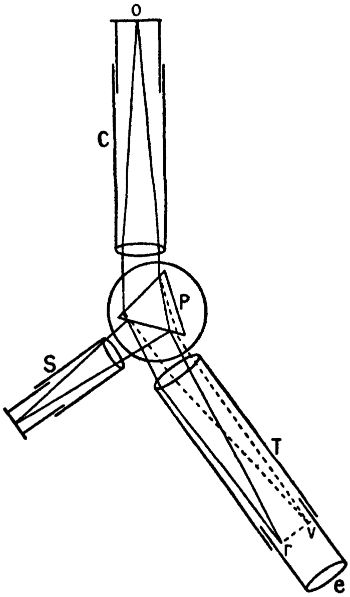
Spectroscope, an instrument for producing and examining spectra. It consists of a central platform on which is placed the prism or diffraction grating, and two horizontal tubes which contain a collimator and a telescope. The collimator produces a beam of parallel rays; it consists of a narrow vertical slit at the outer end of the tube and a convex lens at the inner end, and the slit is placed at the principal focus of the lens. Thus, if a source of light is placed in front of the slit, the rays which pass through the lens will emerge parallel to the axis of the collimator. The prism is placed, with its refracting edge vertical, to receive this beam obliquely on one refracting face, and as each ray is incident at the same angle, it undergoes the same amount of refraction, and the beam which passes out of the prism still consists of parallel rays. The telescope is directed to receive these rays, and the image seen in the telescope depends on the nature of the light employed. A pure spectrum is obtained when the prism is adjusted for minimum deviation.



The Arrangement of the Spectroscope

S, Slit. C, Collimating lens. P, Prism. O, Object glass of Telescope. E, Eye-piece. *f*, Image of slit. *v*, Violet. *r*, Red.

To adjust the spectroscope for use, the eyepiece is focused on the cross-wires; the telescope is removed and focused on a distant object, such as a church spire, and then carefully replaced. The slit is then moved by means of its tube until, no prism intervening, a distinct image of the slit is seen in the telescope. The slit is then made as narrow as possible. The collimator and



The Spectroscope

O, Slit. C, Collimator. P, Prism. T, Telescope. *e*, Eye-piece. *r*, Red. *v*, Violet. S, Tube with scale.

prism may be fixed in place, but the telescope is capable of rotation round a vertical axis passing through the prism, and a scale is provided by means of which the position of the telescope may be determined.

To measure wave-lengths by means of the spectroscope, this scale has to be calibrated by using light of known wave-lengths. For example, if a platinum wire is moistened, dipped in sodium bicarbonate powder, and placed in a Bunsen flame in front of the slit, it gives rise to two yellow lines of wave-lengths 5890 and 5896 in tenth metres or Ångströms (divide by 10^8 to reduce to centimetres). The appearance of these lines in the telescope will give an idea of the resolving power of the instrument. Other salts, such as those of thallium, lithium, and others, may be used in a similar manner, whilst the electric spark between two cadmium wires provides additional lines, and a hydrogen vacuum tube worked by an induction coil supplies other well-known lines. The numbers on the scale may then be related to the corresponding wave-lengths by recording on squared paper in the usual manner.

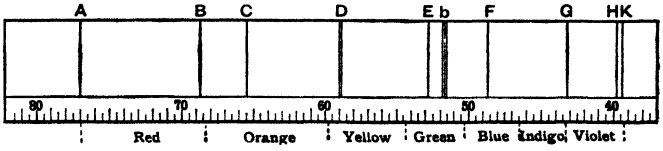
In some spectroscopes a train of prisms is used to obtain greater dispersion and resolving power. A direct-vision spectroscope is one in which the prisms or the grating are placed to give dispersion with little deviation. The echelon spectroscope depends on the principle of interference of light. See *Zeeman Effect.*

Spectroscopy. The use of the spectroscope as an aid to the chemist and physicist began with spectrum analysis, or the detection of a substance present in very small quantity by recognition of its spectrum, and the elements rubidium, cæsium, indium, thallium, and helium were discovered by its means. The mapping of spectra affords a basis for comparing the luminous values of sources of light of different colour; and absorption spectra give the means of assessing the optical qualities of transparent bodies and reflectors as required for light-filters in photography and for other purposes. The spectroscope is also the essential instrument by which the chemistry of the sun and stars has been studied, and the motions of these heavenly bodies have been determined. Examination of the sun's spectrum has revealed the presence of at least half of the elements known to chemistry. The spectra of the stars vary among themselves. Fraunhofer found that some stars, like Arcturus, have spectra like that of the sun; others, like Sirius, have no dark D-lines in their spectra. Secchi, in Italy, distinguished four types of star spectra; in the first group, which includes Sirius and Vega, the light of the star is white or bluish, and the spectrum contains broad dark hydrogen lines. The second group includes stars with yellowish light; these have spectra filled with numerous thin dark lines; the sun is an example of this type. The third group contains red stars, many of them variable; their spectra are of the fluted type, the bright side of the flutings lying nearest to the red end of the spectrum, as in the spectrum of Betelgeuse. The fourth group includes deep-red stars with fluted spectra, in which the fluting is the reverse of that seen in the third group. A fifth group, added by Pickering, contains stars with bright-line spectra. Huggins found that many nebulæ give continuous spectra, whilst others have bright-line spectra, which appears to show that nebulæ are composed of gases in a state of incandescence. By comparing the spectrum of Sirius with that of hydrogen, Huggins noted a very small displacement of the star lines toward the red end of the spectrum. If it is considered that a motion of the star towards the earth will slightly diminish the wave-length of the light which reaches the earth, and that the position of the light in the spectrum is determined by its wave-length, we can infer that a displacement of a star line towards the violet end of the spectrum is caused by motion of the star towards the earth, and that displacement towards the red end means relative motion of separation. It was thus found that Sirius, Rigel, and other stars were moving away from the earth, whilst Arcturus, Vega, and others are approaching the earth. Using this method of observing the shift in the lines in conjunction with improved photographic methods, astronomers have discovered spectroscopic binaries, or double stars, which revolve round each other but cannot be distinguished as double stars in powerful telescopes. Another result which has emerged is that the sun is moving at about 13 miles per second towards a point in the constellation Hercules. Lockyer, in 1866, placed the slit of the spectroscope at the focus of a telescope object-glass, and was able by this method to examine the different parts of the luminous body whose image was formed at the slit. Hale, in America, extended the method to produce, by the spectro-heliograph, photographs of the sun by light of a particular wave-length. A large spectroscope was attached to the great Yerkes telescope, and a second slit was placed in the focal plane of a camera attached to the spectroscope, so that it could be illuminated only by light of one colour. By using electric motors, the image of the sun was caused to move across the first slit, while the sensitive plate was moved behind the second slit. In this manner an image of the sun was obtained in monochromatic light, and the spectro-heliograph gave information as to the distribution of different vapours over the sun's disc. The spectroscope has been employed to study the corona, prominences, and chromosphere of the sun, and the rotation of the sun and planets.

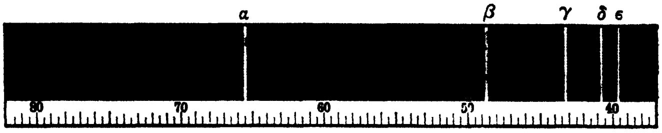
Spectrum, the band of colour formed when the light from any source is dispersed by means of a prism or grating; the term also includes the results of dispersion of the invisible infrared and ultra-violet radiations from the source. Emission spectra are those produced by self-luminous bodies, whilst the spectra obtained from bodies which transmit or reflect light are called absorption spectra, since there is a certain amount of light absorbed during reflection or transmission.

Continuous Spectra.—When a gas-flame or glow-lamp is examined by the spectroscope, a continuous band of light is seen, containing the colours violet, indigo, blue, green, yellow, orange, and red. A continuous spectrum indicates that the luminous body emits visible waves of all kinds; these extend from red (7600) to violet (4000). By special means (see *Spectro-bolometer*) the infra-red spectrum has been observed to about 150,000 tenth metres, and the ultra-violet to about 1200 by photographic methods.

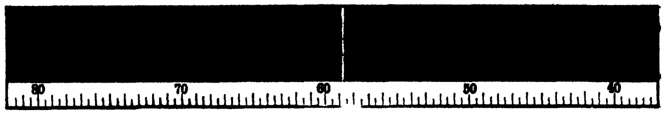
Bright-line Spectra. — The spectrum of a Bunsen flame coloured by an alkaline earth, or of a metal vaporized by the electric spark, or of a gas in a vacuum tube, rendered incandescent by an electric discharge, is one composed chiefly of isolated bright lines. The spectrum of any sodium salt consists of the two characteristic D-lines (5890, 5896). That of iron contains thousands of bright lines. The spectrum of a rarefied gas may be seen by using a Geissler tube containing the gas; it is found to be, in general, of the bright-line variety, but under variation of temperature and pressure a different kind of spectrum is produced.



Solar Spectrum



Spectrum of Hydrogen



Spectrum of Sodium

The scale numbers give the wave-lengths in millionths of a centimetre.

Banded or Fluted Spectra. — Nitrogen, cyanogen, and many chemical compounds give spectra made up of so many series of bright lines that the spectrum has a fluted appearance. Nitrogen has been found to give a bright-line spectrum under a high-tension electric discharge, but a fluted spectrum under a low-tension discharge.

Absorption Spectra.—When a plate of coloured glass is interposed between the source of light and the slit of the spectroscope, the resulting spectrum is found to be deficient in certain kinds of light. The glass absorbs some waves but is transparent to others, and the spectrum obtained by passing white light through red glass, for instance, may have a broad dark absorption band, showing that all the green and blue light has been shut out by the glass.

Dark-line Spectra.—The spectrum of sunlight is found to be continuous, except for the presence of numerous thin dark lines which are due to absorption. These were first observed by Wollaston in 1802, and in 1814 Fraunhofer mapped 576 lines in the sun's spectrum; these are still known as Fraunhofer's lines, and are denoted by the letters A, B, C, &c. (see figure, Solar Spectrum). In 1849 Foucault showed that the bright lines of sodium coincided in position with two dark lines present in the spectrum of the sun; this was verified in 1859 by Kirchhoff, who also identified many iron lines in the sun's spectrum. The explanation of the presence of the dark lines was supplied by an experiment made by Bunsen and Kirchhoff, who showed that when white light passes through cold sodium vapour, the vapour absorbs those constituents of the white light which occupy the position of the D-lines, and, as a result, dark lines appear in the spectrum.

Banded or Fluted Absorption Spectra.—Spectra may occur in which the bands or flutings are reversed, i.e. are dark instead of bright; these can also be explained as the effect of absorption.

Balmer's and other Series.—In 1885 Balmer discovered that the frequencies (ν) of the lines in the visible hydrogen spectrum can be expressed by the formula

$$\nu = N\left(\frac{1}{2^2} - \frac{1}{m^2}\right), \quad (m = 3, 4, \ldots),$$

the value of N (the *Rydberg constant*) being $8{\cdot}290 \times 10^{15}$ sec^{-1}. More recently other series of hydrogen lines have been found, viz. the *Paschen series*, in the infra-red, given by

$$\nu = \mathrm{N}\left(\frac{1}{3^2} - \frac{1}{m^2}\right), \ (m = 4, 5, \ldots);$$

and the *Lyman series*, in the far ultra-violet, given by

$$\nu = \mathrm{N}\left(\frac{1}{1^2} - \frac{1}{m^2}\right), \ (m = 2, 3, \ldots).$$

Balmer's original series included nine lines; R. Wood, using long vacuum tubes, has extended it to twenty lines. These and similar series occupy a very important place in recent physics (see *Spectra, Theory of*).

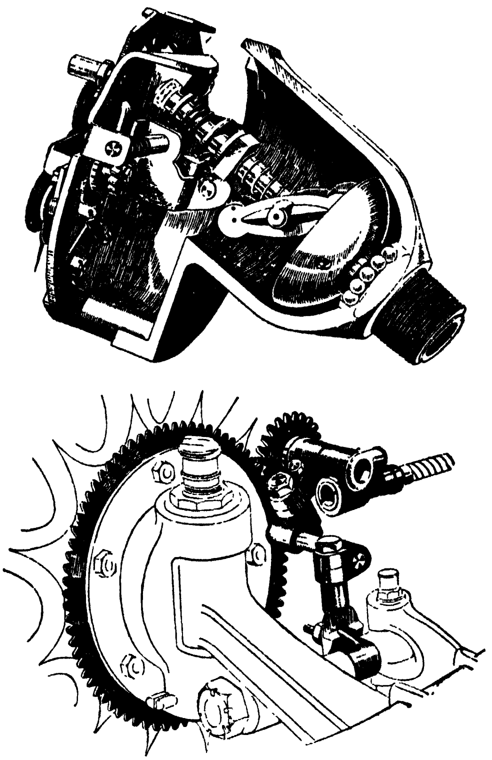
Speculum, in optics and astronomy, a reflecting surface, such as is used in reflecting telescopes, in former times usually made of an alloy of copper and tin (see *Speculum Metal*), but generally now of glass. Those of glass are covered with a film of silver on the side turned towards the object, differing in this respect from mirrors for ordinary purposes, which are coated with tin-amalgam on the posterior side.—In surgery the name is given to an instrument used for dilating any passage, as the ear, or parts about the uterus, with a reflecting body at the end, upon which a light being thrown the condition of the parts is shown.

Speculum Metal, metal used for making the specula of reflecting telescopes. It is an alloy containing 65 to 70 per cent copper and 35 to 30 per cent tin, its whiteness being improved by the addition of a little arsenic.

Speedometer, a device used on motor vehicles to show the rate of travelling and the total distance run. The drive for a speedometer is obtained from a small gear-wheel fixed to one of the front wheels of the car. The speed-indicating part of the mechanism may be operated mechanically or electrically. In the mechanical arrangement the motion of the flexible shaft driven from the gear on the front wheel is used to rotate two masses of metal. These are spring-connected, and take up positions of equilibrium at distances from the centre of rotation which depend on the speed. Motion is taken from the rotating system to move the pointer. In other speedometers electromagnetic actions are used to provide the indication of the speed.

The method of showing the mileage run is to have a train of wheels the first of which is driven by gear-wheels from the flexible shaft. When it makes a complete revolution, a pin fixed to it makes the next wheel revolve one-tenth of a revolution. Further wheels actuated in the same way show the hundreds and thousands of miles travelled. Small cylinders bearing the figures 0 to 9 are fixed to the wheels, and provide the indications on the dial.

All speedometers are calibrated for use with a normal inflation of the tyres. If the tyres are not so fully inflated, the distance travelled each revolution of the wheel will be different from that under which the instrument is intended to be used, and the indications will not be accurate.



The Smith British Speedometer

Above is a sectional view; below is shown the speedometer gear drive as fitted for the front wheel of a motor-car. The pivoted governor arm is shown at its normal rest position when it is inclined to the governor spindle at an angle of about 45°. As the governor spindle is revolving, the arm, under centrifugal force, endeavours to gain the horizontal or flat position, and, as the speed of the governor spindle, actuated by the car speed, increases, the governor arm makes a greater angle to the governor spindle until, at the high speed, the arm is almost horizontal. The action of this arm is controlled by a tension spring, and its movement is conveyed to the speedometer pointer by a link and rack and pinion action. The mileage mechanism is operated by a series of worms and worm wheels positively connected to the driving spindle. The whole of the action of the speedometer is positive, and will give an accurate record both of speed and mileage under any running condition.

Speedwell, the common name of plants of the genus Veronica, nat. ord. Scrophulariaceæ, natives of temperate climates all over the world. The species consist of herbs, undershrubs, or shrubs, with opposite, alternate, or verticillate leaves. The flowers are of a blue, white, or red colour, having two stamens, and are arranged in axillary or terminal spikes or racemes. The number of British species is considerable. *V. officinalis*, or common speedwell, was once extensively used as a substitute for tea, and also as a tonic and diuretic. *V. Teucrium*, or germander-leaved speedwell, has much the same properties as common speedwell, and *V. Chamædrys*, or germander speedwell, is a very general favourite, on account of its being almost the very first to open its flowers in the early spring.

Germander Speedwell (*Veronica Chamædrys*)

Speke, John Hanning, British explorer, born 1827, died 1864. He accompanied Burton's expedition to Somaliland (1854), and Speke and Burton again set out in 1857, directed by the Royal Geographical Society, to explore East Africa. Lake Tanganyika was discovered, and Burton falling sick, Speke proceeded north and discovered the south end of the Victoria Nyanza. In 1862, accompanied by Captain Grant, Speke explored the western and northern margin of the lake, and found a river flowing north and out of the lake, which proved to be the White Nile. His discoveries and adventures were described by him in his *Journal of the Discovery of the Sources of the Nile* and *What Led to the Discovery of the Sources of the Nile.*

Spelling Reform has been advocated at different times and in different countries, when the discrepancy between the written and the spoken language has become marked. The advocates of spelling reform hold that the oldest forms of our own language were approximately 'phonetic' in their spelling; but this cannot be said of the present spelling, in which there are letters that represent no sounds at all (e.g. *a* in *dead*, *b* in *debt*, *c* in *indict*, *d* in *handkerchief*, &c.), and in which the same sound is represented by different letters (e.g. *no*, *know*, *nose*, *toes*, *oak*, *though*, *bureau*, &c.), or the same letter designates different sounds (e.g. *s* in *ease*, *cease*, *sure*, *vision*; *a* in *man*, *many*, *ask*, *lady*). The reformers urge that the retention of a seriously non-phonetic spelling has serious consequences; it presents to the young child, learning to use its mother-tongue for reading and writing, a grave difficulty, by making it accept on authority what is intrinsically non-rational, and leads to the condemnation of many of its 'mistakes' which are phonetically correct; in learning it there is waste of time and energy which could be more profitably employed; it is an obstacle to the wider spread of the English language within the empire and abroad; it tends to implant faulty ideas as to the relation of the written to the spoken language, and to lay stress on 'correct spelling' as a more important criterion of good education than 'correct speech'. Many attempts have been made to reform our spelling. The removal of redundant letters is comparatively simple; the chief difficulty lies in securing a consistent representation of the vowel sounds. The number of English sounds that require symbols is unfortunately larger than the number of letters in our alphabet. Many suggested schemes make use of new letters; others adopt a device found in our spelling, that of the 'two-letter symbol'; *sh* is used to represent a sound which is not a combination of the *s* sound with the *h* sound, *ee* is used to represent a long vowel different from the *e* of *bed.* When English is spelled in any 'reformed' way, it has an unfamiliar appearance which shocks those accustomed to the ordinary spelling; and this feeling of revulsion is at the bottom of the opposition to all attempts at spelling reform. Of the arguments brought forward by opponents, the one most commonly urged is the 'etymological', according to which a change in the spelling would obscure the history of words. But if one of the purposes of spelling is to indicate the derivation of words, ours fulfils that purpose very inadequately; and nations that have a phonetic spelling do not consider themselves at a disadvantage as regards the study of etymology. There is a little more to be said for the criticism that a reformed spelling necessitates an agreed standard of good speech which, it is alleged, we do not possess; but the movement towards standard speech is progressing rapidly, and it would not be difficult in a reformed spelling to make some allowance for slight variations. The reform of English spelling is the special concern of the Simplified Spelling Board of America (founded 1908), and the Simplified Spelling Society (founded 1910), 37 Great Russell Street, London, W.C.1

Spencer, Herbert, British philosopher, born

1820, died 1903. He was educated privately, taught in a school for a time, and from 1837 to 1846 was employed on various railways. In 1842 he contributed to *The Nonconformist* a series of articles on *The Proper Sphere of Government.* From 1848 to 1853 he was sub-editor of *The Economist,* and in 1850 published his work *Social Statics,* wherein he expounded the doctrine of 'the survival of the fittest', and the view which regards progress as involving continual adjustment to environment. Between 1850 and 1860 he published a number of works, in which he dealt with sociological and political questions, but in 1860 he resolved to extend his survey to the problems of life, mind, and society. From 1860 onwards he elaborated and gave to the world his *System of Synthetic Philosophy,* consisting of ten volumes: *First Principles, The Principles of Biology* (2 vols.), *The Principles of Psychology* (2 vols.), *The Principles of Sociology* (3 vols.), and *The Principles of Ethics* (2 vols.). Spencer conceives philosophy as completely unified knowledge, as opposed to science, which is partially unified knowledge, and to the ununified fragments of ordinary knowledge. Science, he says, deals with the Knowable, whilst Religion only deals with the Unknowable ground of phenomena.

Spencer's highest principle, to which all the mutations of phenomena were ultimately reduced, was the Persistence of Force. From it he deduced the principles called by him The Instability of the Homogeneous, The Law of the Multiplication of Effects, and the Law of Segregation. He extended to all phenomena the principle of advance from homogeneity to heterogeneity, or diversity. He called the changes in their totality Evolution, and traced the process of evolution from the primeval, undifferentiated mass of the nebular hypothesis to the human soul with its conceptions of right and duty, through the phenomena of life, mind, and society. In ethics Spencer reconciled the utilitarians with the intuitionalists, and developed the view that what is intuitive in the individual may be developed on a utilitarian basis in the race. Society Spencer treated as an organism, interpreting its changes by the universal laws of evolution.—BIBLIOGRAPHY: Herbert Spencer, *An Autobiography;* David Duncan, *The Life and Letters of Herbert Spencer;* W. H. Hudson, *Introduction to the Philosophy of Herbert Spencer.*

Spence's Metal, formed by melting together iron sulphide and sulphur, is not strictly a metal at all, but a compound, commonly known as regulus. It can be made to look like bronze, and has been used for making busts and similar objects, and also for dentists' dies.

Spenser, Edmund, English poet, was born about 1552, and died in 1599. He was educated at the Merchant Taylors' School and at Pembroke College, Cambridge, where he became an active member of a young literary group headed by Gabriel Harvey. Probably through the latter he found admission later (about 1578) to Sir Philip Sidney and the Earl of Leicester, and cherished hopes of advancement which were disappointed by some imprudence that provoked the ill-will of the influential Burleigh, and Spenser went to Ireland in 1580 in the service of Lord Grey of Wilton. Spenser's first important publication, *The Shepheardes Calender: Conteyning Twelve Æglogues, Proportionable to the Twelve Moneths,* was issued without his name and dedicated to Sidney, and accompanied by a letter to Harvey and an elaborate comment by a certain E. K., probably Edward Kirke. All Spenser's early study of poetry—classical, Italian, French, and English—as well as his ardent political Protestant sentiment, are reflected in these highly artificial yet fresh and even at times naive poems. His admiration for his master Tityrus, i.e. Chaucer, led him to archaise his language, and in those of the eclogues in which he satirizes the clergy of the Anglican Church he writes in the rude accented verse into which English verse had relapsed after Chaucer, reproducing Chaucer's own verse as read in the new English pronunciation. Spenser is more his full poetic self in the poems on other traditional themes of pastoral poetry: eulogy, as in the April song to Queen Elizabeth in the lyrical manner of the *Pléiade;* elegiac lament, as in the November eclogue which echoes the poem by Clément Marot; the praise of poetry and the poet in the noble October eclogue, modelled on Theocritus, the highest strain Spenser had yet sung, touched already with a sense of disappointment, prophetic of the greater poem to follow. *The Faerie Queene* had been begun before Spenser went to Ireland. In this Spenser set himself to 'overgo Ariosto' in the popular romantic epic, a combination of the themes and spirit of mediæval romance with somewhat of the spirit, subjects, and form of classical epic. Spenser's serious temper, and the allegorical tradition of English poetry since Chaucer, led him to make his romance also an allegory of the spiritual and moral education of the perfect courtier, and a reflection of the character and fortunes at court and in camp of his contemporaries Queen Elizabeth, Leicester, Sidney, Raleigh, Lord Grey; and Essex was to have been included. Leicester and Sidney were dead when Raleigh brought Spenser back to court, and the first three books were published with a letter to Raleigh explanatory of the scheme of the poem and numerous dedicatory sonnets. The success of the poem was immediate, but it failed to conciliate the offended Burleigh, and Spenser returned to Ireland in 1590 or 1591. In the latter year a bookseller issued his *Complaints, Containing Sundrie Small Poems of the World's Vanitie*, a collection of poems dating from his earlier years, though some may have been retouched. Of the elegiac pieces the best is *The Ruines of Time* (with beautiful verses on the deaths of Leicester and Sidney); but the most interesting are: *Mother Hubberd's Tale*, a vigorous satire on the clergy, the corrupter courtiers (a digression describes the true courtier), and the proposed Alençon marriage, a poem which is probably the original offence that wrecked Spenser's court career; *Virgil's Gnat*, a flowing translation which refers unmistakably in its dedication and its story to his misfortune; and *Muiopotmos*, a charming *jeu d'esprit* which is also a little parable of the poet and the politician. In 1595 were printed *Colin Clout's Come Home Again*, a charming account of his visit to court with Raleigh; and the *Amoretti* and *Epithalamion*, a sequence of sonnets, with a beautiful *canzone* addressed to his wife. The second set of three books of *The Faerie Queene* was issued in 1596, and in the same year his *Foure Hymnes* (to Love and Beauty, Heavenly Love and Heavenly Beauty) instinct with Italian Platonism, and the *Prothalamion*, another sweet and flowing lyric in the *canzone* manner. His prose *View of the Present State of Ireland* was issued in 1633, thirty-four years after his death.

All Spenser's poems reveal the same qualities, a noble idealism expressing itself at times in a vein of mordant satire, a rich but wonderfully pure and delicate sensuousness, a versification whose melody and sweetness seem inexhaustible. The fullest representative of all these qualities is *The Faerie Queene*. In the first book, written while his hopes were yet undimmed, the story and the allegory of the Christian life and England's struggle with Rome are most successfully blended. In the second, *Temperance*, the allegory becomes more abstract, but the Cave of Mammon is a piece of noble symbolism, and the book is rich in the voluptuous descriptions in which, following his Italian masters, Spenser reveals a more ardent yet purer and more imaginative beauty. In the third and fourth books, in which the stories are run into one another more closely than in the opening books, Spenser's idealism is beginning to flag. The shifting currents of the story of light loves and broken or suspected friendships reflect that aspect of court life on which Spenser comments so bitterly in *Colin Clout's Come Home Again*. Yet these books contain some of the most bewitching things in the poem, symbolic or merely picturesque pageants and scenes, as the gardens of Adonis (iii, 6), the House of Busyrane and Maske of Cupid (iii, 11, 12), the Temple of Venus (iv, 10), the Wedding of the Thames and the Medway (iv, 11); while in Marinell, Belphœbe, Amoret, and Britomart, Spenser has adumbrated with beauty of feeling and description the different aspects of his ideal of womanhood. In the sixth book, of Justice, in Sir Artegall, i.e. Lord Grey of Wilton, Spenser's allegory becomes harder and less instinct with beauty. Sadness but also tenderness predominate in the sixth, of Courtesy, i.e. Sir Philip Sidney, and in the pastoral scenes (cantos 9 and 10) Spenser revives old memories of his early love, and also makes the freest and happiest use of material borrowed from Tasso's *Gerusalemme Liberata*. The fragment of the seventh book is a perfect expression of Spenser's symbolism and his tender melancholy.—Bibliography: Editions: C. H. Herford, *The Shepheardes Calender*; J. C. Smith, *The Faerie Queene*; E. de Selincourt, *Minor Poems*; R. Morris, *Complete Works* (with *Life* by J. W. Hales); Biographies: R. W. Church, *Life of Spenser*; Sir Sidney Lee, *Great Englishmen of the Sixteenth Century*.

Spermace'ti, a fatty material obtained chiefly from cavities in the skull of the sperm whale (q.v.). During the life of the animal the spermaceti is in a fluid state, being dissolved in the oily liquid which is found when the head of the whale is opened. On exposure to the air the spermaceti solidifies, and separates from the oil. Some of the larger whales have been known to yield twenty-four barrels of spermaceti, and from seventy to a hundred barrels of oil. After purification by thorough pressing and treatment with a little potash, it forms white, brittle, semi-transparent crystals. Spermaceti is now used as an ingredient in ointments and salves, but mainly for the manufacture of candles. For this purpose it is usually mixed with small amounts of other waxes to render the candles less brittle.

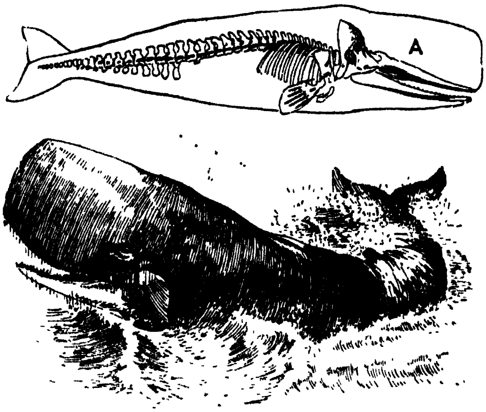
Spermatium, in botany, the non-motile male gamete found in place of the more usual motile spermatozoid in certain Thallophytes, notably the Red Algæ and Uredineæ.

Spermatozo'a, sperms, male sex-cells, each usually consisting of a nucleated body or head and a vibratile filamentary tail, exhibiting active movements comparable to those of the ciliated zoospores of the Algæ, or the ciliated epithelial cells of animals.

Spermatozoid, the botanical name of an actively motile male gamete, propelled by flagella, such as is found in most Algæ (except, e.g., Conjugatæ and Rhodophyceæ), in all Bryophytes and Pteridophytes, and in Cycads and Ginkgo among Gymnosperms.

Sperm-oil, the oil of the spermaceti whale, which is separated from the spermaceti and the blubber. (See *Spermaceti.*) This kind of oil is much purer than train-oil, and burns away without leaving any charcoal on the wicks of lamps. In composition it differs but slightly from common whale-oil.

Sperm Whale, or Cachalot (*Physēter macrocephalus*), a species of cetacea belonging to the 'toothed' whales (Odontoceti) and family Physeteridæ, native to the warmer parts of the ocean. The large blunt head in an old male is sometimes 30 feet long, and forms about a third of the total length of the body; whilst the 'blow-holes' or S-shaped nostrils are situated in the front part of the head. The weight of an adult animal is estimated at about 200 tons, and in a male 66 feet long the flipper measured 5 feet 3 inches, and the two-lobed tail-fin had a breadth of nearly 20 feet. The top of the back is continued almost in a straight line from the upper part of the head; the belly is enormous, but the body thins off towards the wide tail. The colour is a blackish-grey, which may exhibit greenish or bluish hues on the upper parts. The teeth of the lower jaw average each about 3 inches in length. The food consists of squids, cuttle-fishes, and bony fishes. Ambergris is a concretion found in the intestines. This whale is of considerable commercial value. See *Spermaceti.*



Sperm Whale (*Physēter macrocephalus*)

Above is shown the skeleton, A being the cavity filled with spermaceti.

Spey (spā), a river of Scotland, issues from a lake of the same name in Inverness-shire, between Loch Laggan and Loch Lochy, flows north-east through the beautiful valley of Strathspey, forming in part of its course part of the boundary between the counties of Elgin and Banff, and falls into the Moray Firth a little below Garmouth, after a course of about 100 miles. It is noted for its salmon fisheries.

Spezia (spăt'si-a), a seaport-city and winter-resort of Italy, in the province of Genoa, on the Gulf of Spezia (Riviera di Levante). It is the chief Italian naval station, has a marine arsenal, shipbuilding-yards, artillery magazines, barracks, &c., and is strongly fortified. Olive-oil and wine are produced in the vicinity. Pop. 74,000.

Spezzia (spet'si-a), or **Spetsæ**, an island in the Grecian Archipelago, at the eastern entrance of the Gulf of Nauplia, about 3 miles south-south-west of the coast of Argolis; area, 12 sq. miles. Spezzia, on the east coast, is the chief town. Pop. 5000.

Sphacelariaceæ, a small family of filamentous Brown Algæ, section Phæosporeæ, remarkable for the very large apical cell that terminates each branch of the thallus. Sphacelaria and Cladostephus are typical genera.

Sphæriales, one of the main sub-divisions of the Pyrenomycetes (q.v.), distinguished by their hard black perithecia. Typical genera are Leptosphæria and Xylaria.

Sphærobolus, a remarkable genus of Basidiomycetous Fungi, group Gastromycetes. *S. carpobolus* is not uncommon on rotten wood. The wall of the fruit-body contains a contractile layer, by the action of which, at ripeness, the central spore-containing core (*gleba*) is ejected bodily with considerable force.

Sphæropsidaceæ, one of the principal sections of the Fungi Imperfecti, distinguished by their conidia being produced in special chambers (pycnidia). Phoma, with over 1000 species, is one of the typical genera.

Sphærula'ria, a nematode or round parasitic worm existing in certain species of the humble bee. The worm itself is about 1 mm. long, but the female, which alone enters the host, has an enormously extended reproductive apparatus, so that it reaches altogether a length of 15 mm.

Sphag'num, a genus of mosses, widely diffused over the earth in temperate climates, readily recognized by their pale tint, fasciculate branchlets, and apparently sessile globose capsules. They are aquatic plants, and constitute the great mass of our bogs in swampy and moory districts. The leaves have a very peculiar structure, being largely made up of spongy fibrous cells, which absorb water with great avidity. The genus forms a special family, the Sphagnales, which is in some respects intermediate between liverworts and genuine mosses. During the European War sphagnum moss was gathered in large quantities by voluntary workers and used in the hospitals as a surgical dressing for wounds, on account of its absorbent properties.

Sphene (sfēn), a mineral composed of calcium titanosilicate. It occurs mostly as small, hard, yellowish or reddish crystals in syenites and granites. It crystallizes in monoclinic prisms and narrowed pyramids resembling double wedges, whence the name (Gr. *sphēn*, a wedge).

Sphe′nodon, a primitive genus of lizard-like reptiles, and the only living representative of the order Prosauri. The only known species, the tuatara (*S. punctătum*) is a native of New Zealand, and, although once abundant, is now only found on some islets in the Bay of Plenty, North Island. It is also called *Hatteria punctata.*

Sphenophylls, an extinct group of plants allied to the horse-tails, living from Upper Devonian to the end of Permian times. The leaves were wedge-shaped, borne in whorls on delicate ribbed stems. The spores were developed in cones of varied character, and seem to have been all of one kind. The group, of which Sphenophyllum is the typical genus, combines characters of ferns, lycopods, and horse-tails, and may prove to be ancestral to several divisions of vascular plants.

Sphere, in geometry, a solid body bounded by a surface every point of which is at the same distance (the *radius*) from a fixed internal point (the *centre*). The bounding surface itself is also frequently called a sphere. A sphere may be generated by the revolution of a semicircle about its diameter. Every plane section is a circle. To prove this, let N be the foot of the perpendicular on the plane from O, the centre of the sphere; and let P be any point common to the plane and the spherical surface. The angle ONP is a right angle, so that $NP^2 = OP^2 - ON^2$. The locus of P is therefore a circle with centre N, and radius $\sqrt{(OP^2 - ON^2)}$. In the limiting case when N is on the surface, the radius of the circle of section is zero. The plane is then the tangent plane at N; it contains all the straight lines which touch the sphere at N. In modern geometry, the circle of zero radius in which the tangent plane cuts the surface is regarded as a pair of imaginary lines, viz. the lines drawn from N to the circular points at infinity in the tangent plane (see *Geometry*, section on *Non-Euclidean Geometry*). From this point of view, all spheres are cut by the plane at infinity in the same circle, which is called the *circle at infinity.*

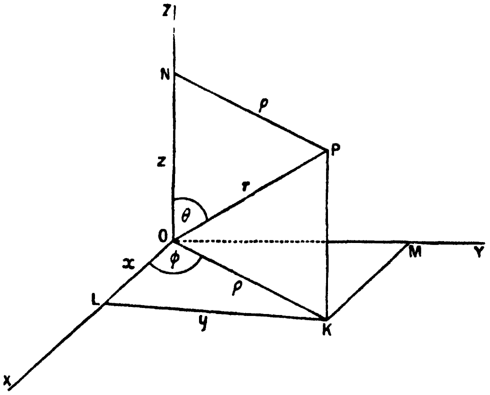
A section by a plane through the centre is called a *great circle*; its radius is equal to the radius of the sphere. A section by a non-central plane is called a *small circle.* Two spheres intersect in a circle, as is easily seen by imagining two intersecting circles to rotate about the line through their centres. The tangent planes at points on a small circle pass through a point, called the pole of the plane of the small circle; the tangents to the sphere from this point form an *enveloping cone*, which becomes an *enveloping cylinder* when the curve of contact is a great circle.

The shortest distance, on the surface, between two points is along the great circle through the points (see *Great Circle Sailing*; *Map*). Three great circles divide the surface into eight *spherical triangles*, which have properties analogous to those of plane triangles (see *Trigonometry, Spherical*). The area of the triangle ABC is $(A + B + C - \pi)r^2$, where the angles A, B, C are in radians, and r is the radius of the sphere.

The volume of the part of the sphere intercepted between two parallel planes is easily found by integration as follows. The area of a section distant x from the centre is $\pi(r^2 - x^2)$; the integral of this expression with respect to x from 0 to x gives the volume between the section x and the parallel central section, viz. $\pi(r^2x - \frac{1}{3}x^3)$. The area of the belt or zone of spherical surface between the same planes is found by differentiating the volume $\pi(r^2x - \frac{1}{3}x^3)$ with respect to r; for the volume of a thin spherical shell of radii r and $r + t$ is approximately the product of the area of either of its curved surfaces by its thickness t. Hence the area of the above zone is $2\pi rx$; so that the area of any zone is $2\pi r \times$ depth of zone. In particular the area of the whole surface is $4\pi r^2$; and the volume of the whole sphere is $\frac{4}{3}\pi r^3$. These results were discovered by Archimedes.—Cf. J. L. Coolidge, *A Treatise on the Circle and Sphere.*

Sphere of Influence. See *Protectorate.*

Spherical Harmonics, functions which occur in the higher parts of nearly every branch of physical mathematics, chiefly in connection with problems relating to spherical and certain other boundaries. Any solution of Laplace's equation, i.e. any function V of x, y, z (the co-ordinates of a point of space) which satisfies the equation $d^2V/dx^2 + d^2V/dy^2 + d^2V/dz^2 = 0$ is called a *harmonic* function, or sometimes a *potential* function (see *Laplace's Equation*; *Potential*). A spherical harmonic is defined to be a harmonic function which is homogeneous in x, y, z; when



expressed in spherical polar co-ordinates r, θ, φ (see figure), it has therefore the form $r^n f(\theta, \varphi)$, and n is called its *degree* or *order*. Harmonics which are rational integral functions of x, y, z of positive integral degree, and the functions derived from these by dividing them by r^{2n+1} (which are easily proved to be also harmonic) are of special importance; they are the only harmonics which occur in problems concerned with complete concentric spherical surfaces, and are therefore called *complete* harmonics. It can be shown that any harmonic function whatever, without singularity in the region between two concentric spheres, can be expanded in an infinite series of these complete harmonics.

Much of the usefulness of the method arises from the simple property mentioned above, viz. that if $r^n f(\theta, \varphi)$ is harmonic, so is $r^{-n-1} f(\theta, \varphi)$. Thus, if we have a potential $r^n f(\theta, \varphi)$ within the sphere $r = 1$, we can infer that the potential outside the sphere is $r^{-n-1} f(\theta, \varphi)$, for the potential is then continuous throughout space. The surface density σ required to maintain this potential is found at once from the surface equation (see *Potential*) $dV/dn_1 + dV/dn_2 + 4\pi\sigma = 0$. For we have (omitting the factor f) $dV/dn_1 = -(d/dr)r^n = -nr^{n-1} = -n$, when $r = 1$; and $dV/dn_2 = (d/dr)r^{-n-1} = -(n+1)r^{-n-2} = -(n+1)$, when $r = 1$. Thus $4\pi\sigma = (2n+1)f(\theta, \varphi)$. Hence a spherical harmonic distribution of density on a sphere produces a spherical harmonic distribution of potential throughout space.

There are many methods for finding the analytical forms of the functions, the most generally useful being based on Laplace's equation in spherical polars, viz.

$$\frac{d}{dr}\left(r^2\frac{dV}{dr}\right)+\frac{1}{\sin\theta}\frac{d}{d\theta}\left(\sin\theta\frac{dV}{d\theta}\right)+\frac{1}{\sin^2\theta}\frac{d^2V}{d\varphi^2}=0.....(1)$$

It is seen at once that $V = r^n \cos m\varphi P(\theta)$, or $r^n \sin m\varphi P(\theta)$ is a solution of this equation, provided $P(\theta)$ is a solution of the equation

$$n(n+1)P+\frac{1}{\sin\theta}\frac{d}{d\theta}\left(\sin\theta\frac{dP}{d\theta}\right)-\frac{m^2}{\sin^2\theta}P=0;$$

if $\cos\theta = \mu$, so that $-\sin\theta d\theta = d\mu$, this equation takes the form

$$\frac{d}{d\mu}\left\{(1-\mu^2)\frac{dP}{d\mu}\right\}+\left\{n(n+1)-\frac{m^2}{1-\mu^2}\right\}P=0.....(2)$$

The main part of the theory of spherical harmonics consists in the discussion of the equation (2). It is shown that in the system of complete harmonics, when n is given, m has only to be given the values 0, 1, 2, . . ., n. The functions have important applications in which n is not a positive integer, and μ not a real number between 1 and -1. Modern discussions therefore deal with the equation (2) on the supposition that μ is a complex variable ranging over the whole plane, and that n and m are any real or complex constants whatever.

Bessel Functions.—The surfaces of the spherical polar system for which r, θ, φ are respectively constant are spheres, right circular cones, and axial planes. The analogous surfaces of the cylindrical polar system are parallel planes, right circular cylinders, and axial planes. It is possible to regard this system as a limiting case of the former, in which the centre of the spheres has gone to infinity. Cylindrical harmonics might therefore be deduced as limiting forms of the spherical functions, but it is simpler to obtain them directly from the appropriate form of Laplace's equation, viz.

$$\frac{d^2V}{d\rho^2}+\frac{1}{\rho}\frac{dV}{d\rho}+\frac{1}{\rho^2}\frac{d^2V}{d\varphi^2}+\frac{d^2V}{dz^2}=0.$$

The function $V = f(\rho)e^{kz}\cos m\varphi$ will be a solution of this equation if

$$\frac{d^2f}{d\rho^2}+\frac{1}{\rho}\frac{df}{d\rho}+\left(k^2-\frac{m^2}{\rho^2}\right)f=0.....(3)$$

This is *Bessel's equation*, and any solution of it is called a *Bessel function.* If t be written for $k\rho$, one solution of (3), denoted by $J_m(t)$, is given by the series

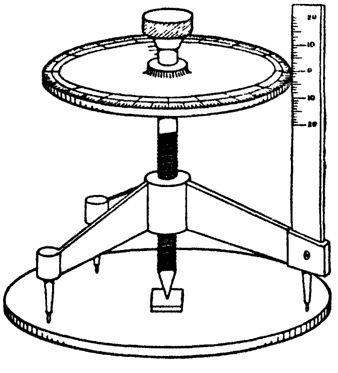
$$J_m(t)=\frac{t^m}{2^m m!}\left\{1-\frac{t^2}{2^2.1(m+1)}+\frac{t^4}{2^4 1.2(m+1)(m+2)}-\dots\right\}$$

Another solution of (3) is $J_{-m}(t)$.

Applications.—In physical mathematics, Bessel functions and spherical harmonics occur more frequently than any other functions, with the exception of simple sines and cosines, and exponential functions. The reason why they appear so regularly is that the great equations of physics, referring as they do to bodies and spaces the properties of which are independent of direction, all involve Laplace's operator Δ^2, which, in rectangular co-ordinates is $d^2/dx^2 + d^2/dy^2 + d^2/dz^2$. Now, if u be a function of a point in space for which $\Delta^2 u = 0$, then it can be shown that the mean value of u over any spherical surface is equal to the value of u at the centre of the sphere. The simplicity and symmetry of this relation may help to explain why Δ^2 should be so important in physics, and why, in problems of attraction, of conduction of heat, of elastic equilibrium and vibration, of fluid motion, and of electrical equilibrium, flow, or oscillation, Bessel's functions and spherical harmonics should be indispensable.—BIBLIOGRAPHY: W. E. Byerly, *Fourier's Series and Spherical Harmonics*; N. M. Ferrers, *Spherical Harmonics*; Whittaker and Watson, *Modern Analysis*.

Sphe'roid, a body or figure approaching to a sphere, but not perfectly spherical; in particular, an ellipsoid of revolution, i.e. a solid generated by the revolution of an ellipse about one of its principal axes. When the axis about which the ellipse rotates is the major axis, the spheroid is called *prolate* or *ovary*; when it is the minor axis, the spheroid is called *oblate* or *planetary*. The earth (q.v.) is approximately an oblate spheroid, the axis of revolution being the polar axis. The volume of any ellipsoid is $\frac{4}{3}\pi abc$, where a, b, c are its principal semi-axes, and the volume of a spheroid is found by the same formula, two of the semi-axes being taken equal.

Spheroidal State, the condition of a small quantity of liquid when, on being placed on a highly heated surface, as red-hot metal, it assumes the form of a more or less flattened spheroid, and evaporates without ebullition. The spheroid in this condition does not touch the surface of the metal, but floats on a layer of its own vapour, and evaporates rapidly from its exposed surface. It is heated mainly by radiation from the hot surface, because conduction is impossible since the layer of intervening vapour conducts heat very feebly. The formation of a layer of non-conducting vapour explains why it is possible to dip the wetted hand into molten iron with impunity.



Spherometer

Spherom'eter, an instrument for measuring the thickness of a small object, or the radius of a spherical surface, such as the surface of a lens. It consists of a micrometer screw working in a nut which is rigidly connected with a metallic tripod, the feet of which form an equilateral triangle. A vertical graduated scale is fixed to one of the legs of the tripod; each division of this scale is equal to the distance between two consecutive threads of the screw. A circular disc attached to the screw is graduated at its circumference, the number of points of division being perhaps 500. If the distance between the threads, or *pitch*, of the screw is 1 mm., then the screw rises or sinks 1 mm. for one complete turn, and a proportionate distance for any fraction of a turn, as read from the graduated disc.

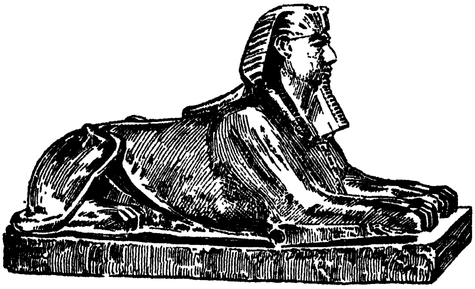
To determine the thickness of a piece of glass, say, the apparatus is placed on a perfectly plane surface, and the point of the screw brought into contact with the plane. The readings are then taken on the scale and disc. The screw having been raised, the glass inserted, and the screw point brought down upon its upper surface, the readings are again taken. The difference of the two sets of readings gives the thickness of the glass.

To ascertain whether a surface is truly spherical, the feet of the tripod are placed on the surface, and the screw turned until its point is also in contact with the surface. If the instrument can then be moved about freely over the surface, all four points continuing to touch it, the surface may be inferred to be exactly spherical. The same adjustment allows the diameter of a sphere to be measured. For the radius r of the circle through the feet of the tripod is a known constant of the instrument, and the height h of the screw point above the plane of this circle is known from measurement. But, by *Euclid* III, 35, or II, 14, if R be the radius of the sphere, $r^2 = h(2R - h)$, so that $2R = h + r^2/h$.

Sphincter, in anatomy, a name applied generally to a kind of circular muscles, or muscles in rings, which serve to close the external orifices of organs, as the sphincter of the mouth, of the eyes, &c., and more particularly to those among them which, like the sphincter of the anus, have the peculiarity of being in a state of permanent contraction, independently of the will, and of relaxing only when it is required that the contents of the organs which they close should be evacuated.

Sphingidæ (sfin'ji-dē), a family of lepidopterous insects, including the hawk-moths. The insects belonging to this division generally fly in the evening or early in the morning, but there are many which fly in the daytime. This family embraces some of the largest European moths, as the death's-head hawk-moth, and the privet hawk-moth.

Sphinx, a fabulous monster which figures both in the Grecian and Egyptian mythologies. The sphinx of the Greeks is represented with a body like that of a lion, with wings, and with the breasts and upper parts of a woman. Hēra, says the fable, provoked with the Thebans, sent the sphinx to punish them. The sphinx proposed a riddle and devoured anyone who undertook but was unable to interpret its meaning. In this enigma the question proposed was, What animal walked on four legs in the morning, two at noon, and three in the evening? This was at last explained by Œdipus, who said that man walked on his hands and feet when young, or in the morning of life; at the noon of life he walked erect; and in the evening of his days he supported himself upon a stick. Whereupon, her riddle being read, the sphinx destroyed herself. The sphinx was used by the Greeks for artistic and decorative purposes, and seems to have been in some sense symbolic. The Egyptian sphinx had a human head (male or female) on the body of a lion (not winged), and was always in a recumbent posture, with the fore-paws stretched forward. The largest sphinx, that near the group of pyramids at Gizeh, is about 150 feet long and 63 feet high; the body is monolithic, but the paws, which are thrown out 50 feet in front, are constructed of masonry. The Egyptian sphinx was probably a purely symbolic figure, having no historical connection with the Greek fable, and the Greeks may have applied the term to the Egyptian statues merely on account of an accidental external resemblance to their own figures of the sphinx.—Bibliography: H. Vyse, *Operations at the Pyramids of Gizeh*; A. H. Sayce, *The Religion of Ancient Egypt*.

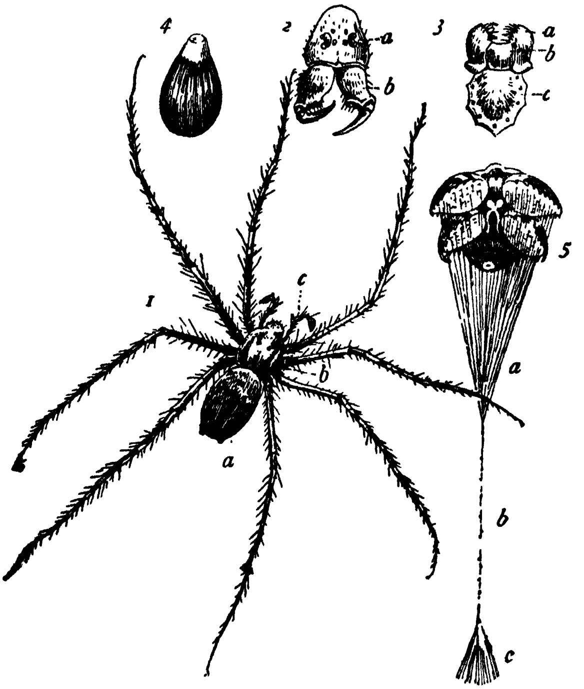


Sphinx of Red Granite inscribed with the name of Thothmes III

Sphinx-moth (*Sphinx convolvuli*), a species of moth belonging to the family Sphingidæ (q.v.), and deriving its popular name from a supposed resemblance which its caterpillars present when they raise the fore part of their bodies to the 'sphinx' of Egyptian celebrity. The sphinx-moth is seldom found in England.

Sphyg'mograph, an instrument for recording the differential features of the pulse in health and disease. The instrument is applied at the wrist, and the pad of the instrument, which rests on the artery, acts as a lever and gives a tracing of the pulse-curve on smoked paper, which is moved by clockwork.

Spider, the common name of familiar arthropods, constituting the order Araneæ of the class Arachnida. The head and thorax are united to form a region known as the cephalothorax; no wings are developed, and breathing is effected by means of pulmonary or lung sacs, usually supplemented by air-tubes (tracheæ). Most spiders are oviparous. The abdomen is furnished with from four to six cylindrical or conical mammillæ or processes, with fleshy extremities, which are perforated with numberless small orifices for the passage of silky filaments of extreme tenuity, with which the females form webs, and which proceed from internal reservoirs. The spider's



1. House Spider. *a*, Abdomen; *b*, Cephalothorax; *c*, Maxillary palpi. 2, Front of Head. *a*, Ocelli; *b*, Mandibles. 3, Under side of Head. *a*, True jaw; *b*, Lower lip; *c*, Sub-mentum. 4, One of the Air-chambers. 5, Spinnerets. *a*, Minute web threads in moist sticky glue; *b*, Threads stuck together with globules of glue which entrap insects; *c*, Anchor of web.

web is usually intended to entangle their prey (chiefly flies), but spiders also spin webs to make their abodes, and for other purposes. The legs number four pairs, and no antennæ are developed, their place being taken by feelers known as pedipalpi. Their jaws or chelicerae are terminated by a movable hook, flexed inferiorly, underneath which, and near its extremity, is a little opening that allows a passage to a venomous fluid contained in a gland of the preceding joint. After wounding their prey with these appendages they inject the poison into the wound, thus quickly destroying the victim. There are usually eight simple eyes. The common garden or cross spider (*Epeira diadēma*), with its geometrical web, is a very familiar species. The great crab spider (*Mygăle cancerides*), and the *M. avicularia* of Surinam, alleged to feed on small birds, are notable forms. To this family also belong the trap-door spiders, which excavate a nest in the ground, and fit to the aperture a curious little door or lid. The tarantula (*Lycōsa tarantŭla*) is regarded in Italy as capable of producing a kind of dancing madness by its bite. The English hunting or zebra spider (*Salticus scenicus*) is a pretty little arachnidan. The *Clotho durandii*, inhabiting Spain and North Africa, is remarkable as constructing a kind of little tent, in the interior of which the eggs, enclosed in little pouches, are contained. The interesting water-spiders (*Argyronēta aquatica*), denizens of freshwater pools, lead a subaqueous life, and construct their nests somewhat in the form of diving-bells with the mouth opening downwards, together with thin webs in which their prey is captured.

Spider-crab, the name given to crabs of the family Maiadæ from the rough general resemblance their bodies and long legs possess to those of spiders. The *Maia squinădo*, or common or thornback spider-crab, is a familiar British species, and is very commonly taken in the crab-pots of fishermen. The four-horned spider-crab (*Pisa tetraodon*) has a triangular body, possessing four horn-like processes in front, the two central ones forming the rostrum or beak. Spider-crabs clothe themselves with various seaweeds, which help to conceal them from enemies.

Spider-fly, Ked, or **Sheep-tick,** a wingless fly of the family Hippoboscidæ, parasitic on the sheep.

Spider-monkey, or **Coaita,** a general name applied to many species of platyrrhine or New World monkeys, but more especially to those of the genus Atĕles, which are distinguished by the great relative length, slenderness, and flexibility of their limbs, absence of a functional thumb, and by the prehensile power of their tails. They range from Mexico to Uruguay. A familiar species is the black-faced spider-monkey (*Atĕles ater*), which occurs in Eastern Peru. The red-faced spider-monkey (*A. paniscus*), another typical species, has an average length of 12 inches; the tail measures over 2 feet long, and the fur is of a dark, glossy, black hue.

Spider-monkey (*Atĕles criodes*)

Spiderwort, the common name of plants of the genus Tradescantia, one species of which, *T. virginica*, is cultivated in gardens.

Spiegeleisen (spē′gl-ī-zn), an alloy of iron and manganese containing about 20 per cent of the latter metal, made from specular iron ore, or a mixture of hæmatite and manganese ore in blast-furnaces. It is largely used in the Bessemer and open-hearth processes of steel-making for the purpose of deoxidizing the metal and reintroducing carbon.

Spigelia, worm-seed, or worm-grass, a genus of plants, nat. ord. Loganiaceæ.

Spike, a species of inflorescence in which the flowers are sessile along a common axis, as in the common plantain.

Spikelet, the name given to each small unit of the compound inflorescence in grasses. It consists of one or more flowers inserted one above the other on opposite sides of a very short axis, the whole being enclosed in one, two, or rarely several, large bracts, the glumes. The spikelets are well seen in the oat, where they are arranged in a loose panicle.

Spikenard, or **Nard,** a highly aromatic herbaceous plant growing in the East Indies, the *Nardostachys Jatamansi*, nat. ord. Valerianaceæ. The root has a strong smell and a sharp bitterish taste. This is the true spikenard of the ancients, and it has enjoyed celebrity from the earliest period on account of the valuable extract or perfume obtained from its roots, which was used in the ancient baths and at feasts. It is called *jatamansi* or *balchur* by the Hindus, and *sumbul* or *sunbul* by the Arabians. It is highly esteemed in the East as a perfume, and is used to scent oil and unguents. The name spikenard is applied to various other plants, as to *Valeriāna celtica*, *Andropōgon Nardus*, and *Lavandŭla Spica* (see next article). In the United States it is applied to *Aralia racemōsa.*

Spike-oil, a volatile oil obtained by distilling *Lavandŭla Spica* (a species of lavender) with water. It has a less agreeable odour than true lavender-oil, and is specifically heavier. It is obtained from the leaves and stalks of the plant, true lavender-oil from the flowers.

Spin'age, or **Spin'ach,** a genus of plants, nat. ord. Chenopodiaceæ. There is only one species, *Spinacia oleracea* (common spinach), well known on account of its use in the kitchen. It is wholesome and agreeable, but contains little nutriment. There are two principal varieties cultivated in gardens—the prickly-fruited and the smooth-fruited. What is called *New Zealand spinach* (*Tetragonia expansa*), a plant of the nat. ord. Ficoideæ, is sometimes used instead of common spinach, as is also Australian spinage (*Chenopodium auricŏmum*). For *mountain spinage*, see *Orach.* Indian spinach is *Basella rubra* and *B. alba.*

Spinal Cord, the name given in anatomy to the great cord or rod of nervous matter which is enclosed within the backbone or spine of vertebrates. The spinal cord in man, which is from 15 to 18 inches long, has direct connection with the brain by means of the medulla oblongata, and passes down the back until it terminates in a fine thread at the level of the first lumbar vertebra. (See *Spine.*) Lodged in the bony vertebræ, it varies in thickness throughout, and like the brain is invested by membranes called respectively *pia mater* and *dura mater.* Situated between these two are the delicate layers of the *arachnoid* membrane, enclosing a space which contains the cerebro-spinal fluid. Besides these protective coverings there is also a packing of fatty tissue which further tends to diminish all shocks and jars. The spinal nerves, to the number of thirty-one on each side, pass out from the cord at regular intervals, pierce the *dura mater*, escape from the backbone, and ramify thence through the soft parts of the body. Eight pairs pass off in the region of the neck called the *cervical* nerves, twelve pairs are *dorsal*, five are *lumbar*, and five *sacral*, while the last pair comes off behind the *coccyx*. In its structure the spinal cord consists of grey and white matter. The grey matter, which is characterized by large cells, is gathered in the centre into two crescent-shaped masses connected at the central part of the cord. The white matter, consisting mainly of fibres, is outside of and surrounds these grey crescents. In its functions the spinal cord forms a tract along which sensory impressions may pass to the brain, and along which motor impulses may travel to the muscles. It is besides a great reflex centre. See *Brain*; *Nervous System*; *Spine.*

Spindle denotes anything slender, but in textiles it refers specifically to the long, thin, steel rods upon which yarn is wound, simultaneously with spinning, either on to the bare spindle or on to a pirn or bobbin surrounding the spindle. Each spindle is provided with a whorl or whirl, adapted to receive an endless band or tape, by means of which the spindle is driven at a speed of 2000 to 10,000 revolutions per minute. The tapes, and therefore the spindles, are driven by means of a rotating cylinder in virtue of the tapes passing partially round cylinder and whorls.

Spindle Tree (Euonymus), a genus of small trees or shrubs belonging to the nat. ord. Celastraceæ. The leading species are from 10 to 30 feet in height; and in autumn they become attractive by reason of their great profusion of seed-vessels, which are generally of a delicate pink or white colour. The common spindle tree (*Euonymus europæus*) is found wild in Britain, in France, and throughout the north of Europe. The wood is of a white colour, finely grained, and hard. It was once esteemed as a material for musical instruments and spindles.

Spine (Lat. *spina*, a thorn), the term applied to the backbone of a vertebrated animal, and so called from the thorn-like processes of the vertebræ. The human vertebral column is composed, in the child, of thirty-three separate pieces, but in the adult the number is only twenty-six, several pieces having become blended together. These separate bones are arranged one on the top of the other, with a layer of gristle between each which helps to unite them, while this union is completed by partially movable joints and strong fibrous ligaments. The first seven vertebræ, which are called *cervical*, occupy the region of the neck; twelve form the supports from which spring the ribs, and constitute the main portion of the back, being accordingly called *dorsal*; five in 'the small of the back' are denominated *lumbar*; five pieces follow which, in the adult, unite to form the *sacrum*;

and four which unite to form the *coccyx*. The vertebral column so arranged presents two forward curves, the first in the neck, the second at the lower part of the back; and two corresponding backward curves. The vertebræ differ in form according as they belong to the cervical, dorsal, or lumbar region, but they have all certain characteristics in common. Each possesses what is called a body, an arch which encloses a ring, and various projections and notches by means of which the bones are articulated. When the vertebræ are in position, the rings are all situated one above the other, and so form a cavity or canal in which lies the protected spinal cord (q.v.). The disease to which this bony structure is most liable is called *angular curvature of the spine* (see *Pott's Disease*). *Lateral curvature of the spine*, unlike the former, is not so much due to disease of the column as to a relaxed condition of the body. It is most liable to attack young rapidly growing persons between the ages of ten and fifteen. Treatment by plaster-of-Paris bandage may be necessary; but strengthening food, regular, moderate exercise, and cold bathing may prove sufficient to effect a cure.

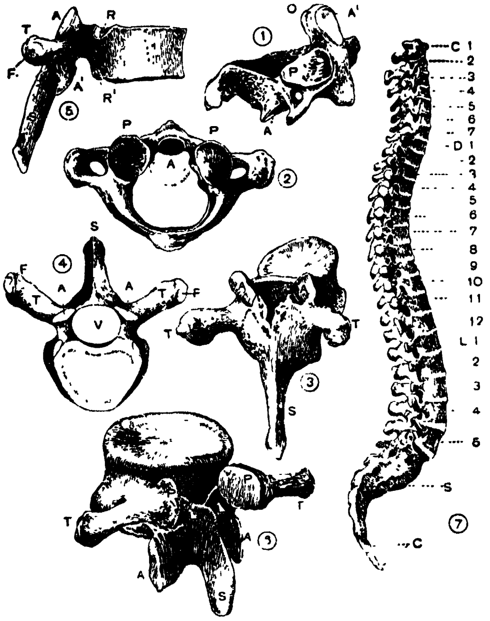


Fig. 1.—The Axis viewed from the right side. O, Odontoid process. A, One of the inferior articulating surfaces. A', Articular surface corresponding with the posterior aspect of the interior arch of the atlas. P, One of the superior articulating processes.

Fig. 2.—The Atlas, from above. A, The articular surface for the odontoid process of the axis. P, P, The inferior articular surfaces.

Fig. 3.—A Dorsal Vertebra from above—perspective view. A, A, Superior articular processes. T, T, Transverse processes. S, Spinous process.

Figs. 4 and 5.—Dorsal Vertebræ (plan and side view). T, T, Transverse processes. S, Spinous process. F, F, Facets for articulation of tubercle of the ribs. A, A', Superior and inferior articulating processes. R, R', Superior and inferior facets for the articulation of the head of the rib.

Fig. 6.—Lumbar Vertebræ seen from behind and above. T, T, Transverse processes. P, P, Superior articular processes. L, Laminæ. S, Spinous process. A, One of the inferior articular processes.

Fig. 7.—Side view of Vertebral Column of an adult male. C, 1–7, The seven cervical vertebræ. D, 1–12, The twelve dorsal vertebræ. L, 1–5, The five lumbar vertebræ. S, Sacrum. C, The four bones of the coccyx.

Spine, in botany, a sharp process from the woody part of a plant. It differs from a *prickle*, which proceeds from the bark. A spine sometimes terminates a branch, and sometimes is axillary, growing at an angle formed by the branch or leaf with the stem. The wild apple and pear are armed with spines; the rose, bramble, gooseberry, &c., are armed with prickles. The term is applied in zoology to a stout, rigid, and pointed process of the integument of an animal, formed externally by the epidermis and internally of a portion of the cutis or corresponding structure.

Spinel, or **Spinelle'**, a species of gem which occurs in crystals and sometimes in rounded grains. Its colours are pink, black, blue, green, brown, and yellow. It is a member of the *spinellid* series of mineral oxides, the general formula of which may be expressed as $R''R_2'''O_4$. The pink spinel used in jewellery, as *balas ruby*, is $MgAl_2O_4$, magnesium and aluminium oxide. *Ceylonite* or *pleonaste* contains a good deal of iron. *Chromite* may be regarded as a chromium iron spinel. The crystalline form is the octahedron of the cubic system. Spinel is found in the beds of rivers in Ceylon and Siam, and embedded in carbonate of lime in North America and Sweden.

Spin'et. See *Pianoforte*.

Spinifex, a genus of grasses, natives of sandy beaches on the Indian and Pacific Oceans. The plants are diœcious, an unusual feature in grasses. The female flowers are massed in heads covered with long elastic spines. When ripe, these heads break off, and, being light, are blown along the shore in a series of jumps at an astounding pace (in the words of the early traveller Rumphius, "as if Old Nick were after them"), thus dispersing the seeds very effectively.

Spinning, in its widest sense, is the art of converting any kind of fibrous material into a compact body. By this process the fibres of wool, cotton, silk, flax, jute, hemp, and the like first pass through various preliminary processes until ultimately a comparatively thick, very slightly twisted, rove or roving is made. From this roving the material is attenuated, a large amount of twist imparted to the thinner thread, and ultimately the spun yarn is wound on to a bobbin, or on to the bare spindle, to be used afterwards according to requirements. From remote times this process was accomplished by means of a distaff round which the wool or other fibre to be spun was coiled, and a spindle or round stick tapering at each end. One end of the stick was provided with a weight, the forerunner of the modern whorl or whirl, while the upper end had a notch for fixing the yarn or thread as the spinning went ôn. The spindle was twirled round, for the purpose of twisting the thread, generally by a movement against the right leg, and while the left hand of the spinner guided and supplied the fibre, the right hand fashioned it into a thread between finger and thumb. The earliest improvement on this method was to fix the spindle horizontally in a frame and cause it to revolve rapidly by means of a band passed round a large wheel. At a later period a treadle motion was added, and the spinner's hands were left free (see *Spinning-wheel*); while a further improvement was effected by the introduction of a double spindle-wheel, with twisting arms on the spindles. This was the spinning implement which obtained until the invention, about 1767, of the spinning-jenny. See *Cotton Manufacture.*

Spinning-wheel, a machine for spinning wool or flax into threads by the hand. It consists of a wheel, band, and spindle, has a distaff attached, and is driven almost invariably by foot, a treadle being employed. Before the introduction of machinery for spinning there were two kinds of spinning-wheels in common use, the *large wheel* for spinning wool, and the *small* or *Saxon wheel* for spinning flax.

Spin'ola, Ambrosio, Marquis de Los Balbases, Spanish soldier, born 1569, died 1630. He became commander-in-chief of all the Spanish and Italian forces in the Netherlands in 1604. During the following five years he frequently encountered Maurice, Prince of Orange, with no decisive results, and at length the war was finished by an armistice (1609). Spinola was next actively engaged in the Thirty Years' War. In 1624 he invested and reduced Breda after ten months' siege. This was his last great military achievement.

Spino'za, Baruch, or Benedict, Dutch philosopher, born at Amsterdam 1632, died 1677. After studying Greek and Latin, he commenced the study of theology. The works of Descartes falling into his hands, he read them with avidity; and the Cartesian maxim "that one should receive nothing as true that was not established by good and solid reasons" corresponded so entirely to the instincts of his inquiring spirit that he determined to adopt it as a guiding maxim for himself. He was excommunicated on account of his unorthodox views in 1656, and as his life was endangered at Amsterdam he left the city, and settled in 1669 at The Hague, where he remained till his death. He acquired the art of grinding optical glasses; and it was by practising this art that he supported himself.

Spinoza's first work, the *Tractatus Theologico-Politicus*, was published anonymously in 1670, and because it put forth a strong plea for liberty of speech in philosophy, it was placed on the *Index* by the Catholics, and condemned by the authorities in Holland. Spinoza's most important work is the *Ethics*, wherein he developed his system of philosophy by means of a series of axioms and definitions after the method of Euclid in his geometry. The central conception of his system, which is pantheism (q.v.), may be briefly summed up as follows: There is one substance in the world, which is God. He is infinite and absolute. All other finite substances proceed from God, who is the inherent cause of the universe, and have only a fleeting, transient existence. God, or the Infinite, has two attributes by which He reveals Himself unto us: extension and thought. Extension modified forms bodies, thought modified forms minds. Man, being only a part of the greater whole, has neither a separate existence nor a self-determining will; but he can, by means of knowledge and love, so far control his passions as to enter into the joy which springs from this idea of an all-embracing God. Spinoza, who had been accused by his enemies of atheism, was full of love for the Deity, whom he recognized in all nature. His philosophy has exercised an immense influence over the greatest minds of Europe, among which may be reckoned Goethe, Lessing, Herder, Heine, and Shelley.—BIBLIOGRAPHY: J. Martineau, *A Study of Spinoza*; J. Caird, *Spinoza*; F. Pollock, *Spinoza: his Life and Philosophy*; R. A. Duff, *Spinoza's Political and Ethical Philosophy.*

Spinthariscope, an instrument invented in 1903 by Sir William Crookes for exhibiting certain brilliant scintillations due to radium. It consists of a brass tube with a lens at one end, and at the other a screen of zinc sulphide with a small bit of radium in front of it.

Spir'acle, the name given to the apertures which exist on the sides of the body in insects, centipedes, spiders, &c., and through which air is admitted to the breathing organs, which consist of air-tubes. As commonly seen, each spiracle presents the form of a rounded or oval opening, the margin of which is formed by a horny ring. The opening itself may be closed by a kind of grating, and may be surrounded by delicate bristles or hairs. The name is also applied to the single nostril of the hag-fishes, the blow-hole of the cetaceans, &c.

Spiræ'a, a genus of plants, nat. ord. Rosaceæ. The species, which are diffused through the temperate parts of the northern hemisphere, consist of small unarmed shrubs or perennial herbs, with simple or compound leaves, and racemes or corymbs of white or reddish flowers. Several North American, Indian, and Japanese shrubby species are in cultivation. Two species are British, and are known by the name of *meadowsweet.*

Spiral, in geometry, a curve (usually plane) traced by a moving point which revolves round a fixed point (the *pole*), the distance between the pole and the tracing point being variable. If the pole be taken as origin of polar co-ordinates r, θ, then in the equation of a plane spiral r is a function of θ which does not return to the same value when θ increases by four right angles. Two important examples are: (1) the *equiangular* or *logarithmic spiral*, $r = ae^{\theta \cot \alpha}$, in which the tangent at any point is inclined at a constant angle to the radius vector; (2) the *spiral of Archimedes*, $r = a\theta$.

Spires (Ger. *Speyer* or *Speier*), a city of Bavaria, on the Rhine. In early times Spires was a fortified outpost of the Romans, and after Charlemagne it was long the residence of the Emperors of Germany and the seat of the Germanic Diet. There is a cathedral, a Romanesque basilica, begun in 1030 by Conrad II. When the city was burned by Louis XIV (1689), only the blackened walls remained, and the ashes of the eight German emperors buried in the choir were scattered. It was reconstructed between 1846 and 1856. At the Diet of Spires (1529) the Lutherans adopted the protest which conferred on them the name of Protestants. From 1801 to 1814 the city belonged to France. Pop. 23,300.

Spirit-level, an instrument employed for determining a line or plane parallel to the horizon, and also the relative heights of ground at two or more stations. It consists of a tube of glass nearly filled with alcohol or ether, and hermetically sealed at both ends, so that when held with its axis in a horizontal position, the bubble of air which occupies the part not filled with the liquid rises to the upper surface and stands exactly in the middle of the tube. The tube is placed within a brass or wooden case, which is laid on the surface to be tested, and the slightest deviation from the horizontal is indicated by the bubble rising towards the higher end of the tube.

Spiritualism, the opposite of materialism, is the term used in philosophy to indicate the doctrine of the existence of spirit as distinct from matter. According to this system of philosophy, all that is real is spirit, mind, or soul, the external world or matter being only a succession of notions impressed on our minds by the First Cause or the Deity, or a mere production of the mind itself. The term spiritualism, however, is now also specifically applied to the belief that communication can be held with departed spirits by means of rappings or noises, writings, visible manifestations, &c. The belief in such manifestations has long existed, but in its limited and modern form spiritualism dates from the year 1848. In this year a Mr. and Mrs. Fox, who lived with their two daughters at Hydesville, New York, were disturbed by repeated and inexplicable rappings throughout the house. At length it was accidentally discovered by one of the daughters that the unseen 'rapper' was so intelligent as to be able to reply to various pertinent questions, and so communicative as to declare that he was the spirit of a murdered pedlar. When this discovery was noised abroad, a belief that intercourse could be obtained with the spirit-world became epidemic, and numerous 'spirit-circles' were formed in various parts of America. The manifestations thus said to be got from the spirits were rappings, table-turnings, musical sounds, writings, the unseen raising of heavy bodies, &c. Part of the peculiarity of these phenomena was that they were always more or less associated with a medium, who was supposed to have an organization sensitive enough to communicate with the spirit-world. It was about this time that hypnotism began to arouse scientific interest and to contribute to the cause of spiritualism. It had first been investigated by Mesmer (q.v.) between 1770 and 1780, and was originally called *Mesmerism.*

One of the most remarkable personalities in the movement was William Stainton Moses, born in 1839, and educated at Oxford. He became editor of the Spiritualist paper *Light*, and his two works *Spirit Identity* and *Spirit Teachings* were widely read. The first professional medium who came to Europe was a Mrs. Hayden, and she was followed in 1855 by Daniel D. Home, who visited nearly all the courts of Europe. The latter possessed unusual powers, and was said to be able to float up to the ceiling or out of the window into the next room. Such claims not only attracted the curious and converted the unthinking, but also received the attention of legal and scientific men. In America, Judge Edmonds and Professor Hare undertook to expose their fallacy, but both had to admit the genuineness of some of the evidence. Jointly with Dr. George Dexter, Edmonds published a work entitled *Spiritualism*, which soon became a classic. In England the truth of the phenomena gained the assent of such eminent converts as A. R. Wallace, Sir William Crookes, Professor De Morgan, and W. T. Stead. The London Dialectical Society appointed a committee to investigate the phenomena, and the report (1871) admitted the genuineness of the phenomena, but did not seek to explain their origin. In America the believers in spiritualism are now very numerous, and have many newspapers, magazines, and books to explain and enforce their belief. Notwithstanding this testimony, spiritualism has been greatly discredited in England by the fact that nearly all public mediums have been convicted of fraud. The popular belief seems to be that the phenomena of spiritualism are the result either of self-delusion on the part of believers, unconscious deception on the part of the medium, or clever conjuring.

The more recent investigations of the Psychical Society, however, seem to show that there are forces connected with hypnotism and its kindred phenomena which may explain the occult occurrences of spiritualism by natural, though hitherto little known, laws. The interest in spiritualism was greatly revived during the European War. Apart from scientific curiosity and a love of the marvellous, the assurance of life after death was a consolation to the thousands who were mourning over their lost ones. It also attracted many people who were anxious to obtain advice and information about mundane matters through mediums. One of the most famous believers in the supernatural character of psychical phenomena in recent years is Sir Oliver Lodge, who in 1916 published a work entitled *Raymond, or Life and Death*.—BIBLIOGRAPHY: A. R. Wallace, *Miracles of Modern Spiritualism*; F. Podmore, *Aspects of Psychical Research*; F. W. H. Myers, *Human Personality and its Survival of Bodily Death*; J. H. Hyslop, *Psychical Research and Survival.*

Spirit Worship. See *Animism.*

Spirogyra, a genus of freshwater Green Algæ, group Conjugatæ. The cylindrical cells that make up the unbranched filaments are relatively large, and are excellent objects for the microscopic study of the living cell. The most conspicuous feature is the bright-green, spirally twisted chloroplast (one to several in each cell), to which the genus owes its name. Several species are abundant in ponds and ditches in Britain.

Spir′ula, a genus of cuttle-fishes or cephalopods, including only one species, and so named from their very delicate shell being rolled into a spiral form. The shells are very numerous on the shores of New Zealand, but the animal forming them is extremely rare, being seldom found except in a fragmentary state.

Spit′alfields, a district of East London, in the metropolitan borough of Stepney. The manufacture of silk was introduced here by French Protestant refugees after the revocation of the Edict of Nantes (1685). The Spitalfields market for vegetables and fruit dates from the times of Charles II. The parish is named from the hospital of St. Mary, founded in 1197.

Spitsber′gen, a group of six large and several small islands in the Arctic Ocean; area, about 25,000 sq. miles. The largest are: West Spitsbergen (Mainland), Barents Land, Hope Island, King Karl's Land, Bear Island, Edge Island, Prince Charles Foreland, and North-East Land. The climate is severe, and vegetation is confined to narrow limits. For four months in winter the sun is below the horizon, and for an equal period in summer always above it. The larger animals are foxes, bears, and reindeer, while sea-fowl are numerous. Coal of Devonian and Carboniferous age is found in Bear Island, and has been mined since 1915. The group was discovered in 1553 by Willoughby, the English navigator, and was again visited in 1596 by the Dutch navigator Barents. Among later explorers are Leigh Smith, Nordenskjöld, Sir Martin Conway, and Professor Gregory. The islands have been used as a base for polar expeditions. In 1920 (treaty signed 9th Feb.) Spitsbergen was placed under Norwegian sovereignty.

Spleen, in man, the chief of the ductless or blood glands, the action of which is supposed to affect the quality of the blood. This gland, which in man is situated in the belly to the left side of the stomach, is an elongated, flattened structure about 5 inches in length, 3 inches broad, and 7 oz. in weight. Its supply of blood is received directly from the aorta by means of the *splenic artery*, and, after passing through the organ, is carried off by the *splenic vein* which joins the portal vein. It is composed of a fibrous tissue divided into an irregular network of spaces which contain the *spleen pulp*. This pulp consists of masses of round white corpuscles, some larger and some smaller, which are called the *Malpighian bodies* of the spleen. Through each one of these cellular masses there passes a branch from the splenic artery, and in this way the blood filters through the pulp as though it were a sponge, and is then collected by the veins. The function of the spleen is not clearly known, but it is supposed that the active cells of the pulp either remove old red cells from, or add new white cells to, the blood current in its passage through the organ.

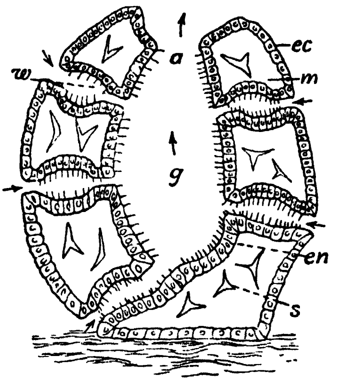
Spleenwort, the common name of various British ferns of the genus Asplenium. They grow upon rocks and old walls.

Spohr, Ludwig, German violinist-composer, born 1784, died 1859. At an early age he composed some violin duets and short pieces, and, when fourteen years old, the Duke of Burgundy became his patron, and sent him on a long tour with Franz Eck, who acted as his companion and tutor. Spohr returned to Brunswick (1803), where he was greatly influenced by the playing of Rode, and after a successful tour of the German cities, his fame now being firmly established, he became (1805) leader of the band to the Duke of Gotha. In this position he was enabled to travel extensively, conducting at Gotha, Vienna, and Cassel, and, at intervals, touring Europe. His compositions include operas, oratorios, a large amount of chamber-music, symphonies, and other orchestral music, violin concertos, and duets as well as songs and part-songs, amounting altogether to over 200 works. These are all markedly individual, but, as the individuality itself was not of the strongest type, his place as a composer is not among the greatest. He is best known by his violin concertos and by his book, *Violin School.* As a critic his record is remarkable, since he condemned, with great emphasis, some of the finest works of Beethoven, and yet was one of the first to recognize the genius of Wagner.

Spokane, a city of Washington, United States, the county seat of Spokane county, at the double falls of Spokane River, which provide hydro-electric power; served by the Northern Pacific, Great Northern, Union Pacific, and other railways. It is a supply-point for the Oregon, north-central Idaho, and East Washington mining regions, and is the transport centre of a rich agricultural country. There are foundries, machine-shops, saw- and lumber-mills, and flour-mills. Pop. 104,000.

Spole'to (ancient **Spoletium**), an ancient town of Italy, in the province of Perugia. Several of the churches occupy the sites of Roman temples. Spoleto was colonized by the Romans in 241 B.C. In 574 it became the capital of the Lombard Duchy of Spoleto, and from 1220 to 1860 it was a Papal possession. Pop. 10,000.

Sponge, the name commonly given to the animals of the class Porifera, a class of organisms representing a distinct morphological type, intermediate between the Protozoa and the Cœlenterata. The typical members are composed of two elements, an internal supporting framework or skeleton, and a soft gelatinous investing substance called *sarcode,* or ' flesh '. The framework consists of horny, reticulated, elastic fibres, which interlace in every direction, strengthened by calcareous, or, more generally, by siliceous spicula. This framework is the sponge of commerce. The sponge-flesh investing this framework is composed of an aggregation of organless, protoplasmic, and amœbiform bodies, some ciliated and others capable of emitting pseudopodia. A constant circulation of water goes on in the living sponge, and by this circulation the animal is nourished. Reproduction takes place both by gemmation and true ova. Sponges have been classified into three groups: (*a*) Myxospongiæ, few in number, in which no skeleton of any kind exists; (*b*) Calcispongiæ, or limy sponges, which have no horny skeleton, but are composed of limy spicules; (*c*) Fibrospongiæ, or those in which a fibrous skeleton exists, strengthened usually by flinty spicules. The name *glass-sponges* is given to certain sponges having a highly ornamental glass-like appearance. Venus's flower-basket and the glass-rope zoophytes are examples. In common usage the term sponge is employed to designate the fibrous framework of sponges as sold in our shops. This framework is soft, light, and porous, easily imbibing fluids, and as readily giving them out again upon compression. Sponges are usually prepared before they come into the market, by being beaten and soaked in dilute muriatic acid, with a view to bleaching them and dissolving any adherent carbonate of lime. The kinds most fit for use are found in the seas of warm climates. Two species are chiefly brought from the Levant, and a coarse one from the West Indies and the coast of Florida. Sponges have been artificially cultivated in the Adriatic and in Florida by means of planting cuttings in suitable waters.



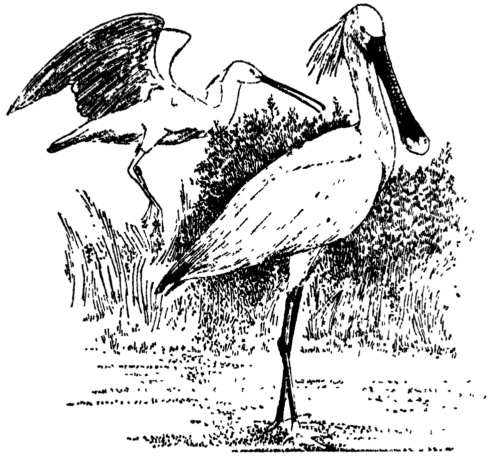
Diagrammatic Enlarged Vertical Section of a Simple Sponge

ec, External body-layer *m,* Middle body-layer, with spicules. *s, en,* Internal body-layer, made up of flagellated cells and extending into the canals (*w*), which pierce the side-wall of the body, opening into the central cavity, *g,* that also communicates with the exterior by a large aperture, *a.* The arrows indicate the course taken by the currents of water which traverse the body.

Sponsor (Lat. *spondēre,* to promise), one who is surety for an infant at baptism, a godfather or godmother. Until the ninth century the actual parents were allowed to become sponsors, but this was prohibited by the Council of Mainz (813), and the prohibition still continues in the Roman Catholic Church. The Roman and Greek Catholic Churches consider the relation of the sponsor to the godchild a kind of adoption, and therefore forbid marriage between them.

Spontane'ity, the initiation of movements, &c., in living organisms without direct reference to any external stimulus. Such movements are prompted simply by the discharge of energy from the nervous system as the result of *internal* stimuli.

Spoonbill, the popular name of the birds of the genus Platalea belonging to the ibis family (Ibididæ), order Ciconiiformes, from the shape of the bill, which is somewhat like a spoon, being curiously widened out at the tip. They live in societies in wooded marshes, generally not far from the mouths of rivers, and on the sea-shore. The white spoon-bill (*P. leucorodia*) inhabits Europe generally, being rare, however, in England, although common in Holland in summer. As winter approaches it migrates to the salt marshes on the Mediterranean coasts. The colour is pure white, the breast being yellow, with a naked patch of skin on the throat; the legs are black, and the bill, which is about 8 inches in length, is black, and yellow at the tip. Other species are native to Africa, Eastern Asia, and the Australian region. The allied roseate spoonbill (*Ajaja rosea*) is an American species, with the plumage of a fine rose colour.—The name of spoonbill is also given to a kind of sturgeon (*Polyŏdon folium*) found in the Ohio, Mississippi, &c. See *Paddle-fish.*



Spoonbill (*Platalea leucorodia*)

Spoon-worm, a name for various marine animals of the phylum Gephyrea, in particular *Thalassēma neptūni,* so called on account of the spoon-like appendage to the proboscis. This species is found on the coast of England, and much used as a bait by fishermen. All the species of this genus are remarkable for the wonderful power of contraction and expansion possessed by the skin, and the extraordinary manner in which they can alter their shape. Allied spoon-worms belong to the genus Sipuncŭlus.

Spor′ades, the general name for a group of small islands in the Grecian Archipelago, lying to the east of the Cyclades. The principal are Scio or Chios, Samos, Cos, Rhodes, Lesbos, and Patmos. The name Sporades is derived from the Gr. *speirein,* to sow, indicating the scattered position of the islands. The Sporades belonged to Turkey, but during the Turko-Italian War Greece seized twelve of the Sporades, and occupied the remainder during the Balkan War. By the Treaty of Sèvres they were allotted to Greece.

Sporan′gium, in botany, a propagative organ producing spores internally, seen typically in ferns or in Mucor.

Spores, applied in zoology to hard-coated reproductive cells produced in some of the lowest animals, especially the Protozoa, which, together with plant spores, may be borne in immense numbers by the atmosphere.

Spores, in botany, a general term used for all reproductive cells other than gametes (q.v.). In Algæ the principal forms are the motile zoospores serving for asexual propagation, and the zygospores and oöspores formed by sexual fusion. The spore-forms of Fungi are very diverse. In Cormophytes the term is applied specifically to the reproductive cells of the sporophyte generation; in homosporous plants, such as ferns, these are all of one kind, but in heterosporous types, such as Selaginella or the seed-plants, there are distinct microspores and megaspores.

Sporogonium, in botany, the spore-producing structure in Bryophytes (Mosses and Liverworts), consisting typically of a spore-case proper or *capsule* and a stalk or *seta.*

Sporophyte, the asexual or neutral phase in plants which have alternating generations; it is the dominant and conspicuous phase in Pteridophytes and seed-plants. Opposed to gametophyte (q.v.). See *Generations, Alternation of.*

Sporozoa, parasitic protozoa which reproduce themselves by spore-formation. They are found as parasites in practically all the great groups of animals. In the young state they live within the cells of the host, and in some forms remain there throughout life. They cannot assimilate any but liquid nourishment. They vary greatly in size, from extreme smallness up to 16 mm. The Sporozoa have been divided into the subgroups Gregarinida, Coccidiidea, Hæmosporidia, Myxosporidia, and Sarcosporidia. The Gregarinida are found in the alimentary canal of most animals. As many as a dozen of them may be joined together. The Coccidiidea mainly infest epithelial cells, and the Hæmosporidia the blood corpuscles. Myxosporidia are parasitic in worms, arthropods, polyzoa, and vertebrates. *Glugea bombycis,* which causes the disease *pébrine* (q.v.) in silk-worms, belongs to this group. Sarcosporidia live in the striped muscular fibres of certain vertebrates. They have been called Mischer's tubes, and the spores are known as Rainey's corpuscles.

Sports, The Book of, a popular name for the proclamation issued in 1618 by James I, and ordered to be read in all churches, wherein it was declared that dancing, archery, May-games, morrice-dances, leaping, vaulting, and other such games were lawful on Sunday after divine service, but prohibiting bear-baiting, bull-baiting, bowling, and interludes. The order to read this declaration was largely disregarded, but in the reign of Charles I it was republished (1633) and enforced with severity. This created great outcry and opposition, and in 1644 the Long Parliament ordered all copies of it to be collected and publicly burned.

Spotiswood, or **Spotswood,** John, Archbishop of St. Andrews, born 1565, died 1639. He was educated at the University of Glasgow. As a favourite with King James he was selected to go with the king to England (1603), but, the vacancy having unexpectedly occurred, he was appointed Archbishop of Glasgow; afterwards (1615) he was translated to the archbishopric of St. Andrews, and became Primate of Scotland; while in 1633 he crowned Charles I at Holyrood, and two years thereafter was made Chancellor of Scotland. By his harsh prosecution of Lord Balmerino for sedition, and by other measures, he became unpopular, and for his endeavours to force the liturgy and book of canons into Scotland he was deposed by an Assembly held at Glasgow in 1638.

Spotted Fever is one of the names given to cerebro-spinal fever (q.v.).

Spottiswoode, William, mathematician and physicist, born in London 1825, died 1883. He was educated at Balliol College, Oxford. In 1845 he took a first class in mathematics, and in the following year became manager of the printing establishment of Eyre and Spottiswoode, of which his father was a partner. He contributed many mathematical papers to the *Philosophical Transactions*, and was the author of a very useful pioneer treatise on determinants. He was president of the Mathematical Society (1871), of the British Association (1878), and of the Royal Society from 1879 till his death.

Spout-shell, a name sometimes given to the pelican's foot (*Aporrhais pes-pelĕcani*), a British sea-snail: so called from the manner in which the aperture of the shell is lengthened into a kind of spout in front. Also a name for several molluscs that squirt out water, especially the bivalve razor-shells (Solen).

Sprain, the violent straining or twisting of the ligaments and tendons which form the soft parts surrounding a joint. The ordinary consequence of a sprain is to produce some degree of swelling and inflammation in the injured part. The best treatment is to give the limb perfect rest, by means of splints or otherwise, and to foment the part for an hour or two with warm water.

Sprat, a small fish of the herring family, *Clupea sprattus.* At one time the sprat was thought to be the young of the herring, pilchard, or shad; but it can be easily distinguished from the young of any of these fishes by means of the sharply notched edge of the abdomen, the ventral fins beginning beneath the first ray of the dorsal fin, and by the want of axillary scales to the ventral fins. It is found in the North Atlantic and Mediterranean, and on many parts of the British coasts. It is generally considered as a delicious, well-flavoured, and wholesome fish. It is also known by the name of *garvie,* or *garvie herring.*

Spraying, in agriculture, a term applied either to the distribution of liquids, in the form of finely divided sprays, over fruit-trees and farm and garden crops to prevent or destroy injurious insects and Fungi; or to the dusting of powder for a similar purpose. A solution of copper sulphate is used to destroy charlock, and the Bordeaux mixture (or its equivalent) to prevent potato disease.—Cf. article in *Standard Cyclopedia of Agriculture.*

Spree (sprā), a river of North Germany, rises in the east of Saxony, enters the Prussian province of Brandenburg, passes the towns of Spremberg, Kottbus, Lübben, &c., traverses Berlin, and a little below Charlottenburg joins the Havel at Spandau, after a course of about 220 miles. The Friedrich Wilhelm Canal connects it with the Oder a short distance above Frankfurt.

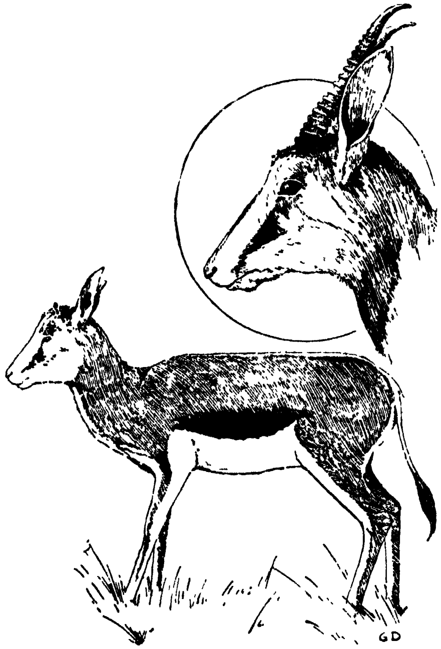
Spring, one of the four seasons of the year. For the northern hemisphere what is called the astronomical season of spring commences when the sun enters Aries, or about the 21st of March, and ends at the time of the summer solstice, or about the 21st of June. In common language, and for meteorological purposes, spring is regarded as consisting of the months March, April, and May. In the southern hemisphere the astronomical spring begins 23rd September, and ends 22nd December.

Spring, an outflow of water from the earth. Springs may result from a variety of causes, chief among which is the percolation of rainwater through a pervious rock intercalated with impervious material until it reaches a plane of faulting, and is enabled, through the pressure of the water behind, to reach the surface. Where mineral matter, &c., has been taken up, *mineral springs* are formed. Hot springs are closely associated with vulcanicity. See *Geyser.*

Spring, in engineering, elastic material so shaped that its compression and the recovery to its unstressed form may be made available for practical use. Although any material with elastic properties may be used for the purpose, those in most common use are made of steel. The properties of the simple helical or spiral spring are so well established that they are usefully employed in weighing. In some types of indicators (q.v.) double spiral springs are used to prevent the bulging and the consequent excessive friction against the cylinder wall which might otherwise be produced. In clocks and watches, the tendency of a metallic coil to unwind is used to provide the motive power. A type made up of a number of arched steel strips held together by buckles is in extensive use in the springing of railway carriages and wagons, and for all types of road vehicles.

With the use of the same rod for their construction a spring of small diameter will safely stand higher stresses than one of larger diameter, but this does not hold down to extremely small sizes, as the rod would be injured in coiling and the steel weakened.

Spring-bok, or **Spring-boc** (*Antidorcas euchŏre*), a species of antelope nearly allied to the gazelle, found in vast herds in South Africa, and used as food by the colonists. It is a very beautiful animal, of graceful form and fine colours—fulvous brown on the upper parts, pure white beneath, with a broad band of deep vinous red where the colours meet on the flanks. It is larger than the roebuck, and its neck and limbs much longer and more delicate. The horns curve in a lyre-shape, and are small in the female. It receives its name from its singular habit of leaping perpendicularly to the height of several feet.



Spring-bok (*Antidorcas euchŏre*)

Springfield, the name of four cities of the United States. (1) A city of Massachusetts, the county seat of Hampden county, on Connecticut River. Slaughtering and meat-packing, paper goods, automobiles, fire-arms (in the Federal arsenal and the Smith & Wesson factory), founding, and machine-shop products are important manufactures. Pop. 129,700. (2) A city of Ohio, the county seat of Clark county, on the east fork of Mad River. It is an agricultural centre, and has flour-mills and manufactures of implements. Pop. 61,000. (3) A city of Illinois, the county seat of Sangamon county, on Sangamon River. It is the centre of an agricultural region, and has a coal-shipping industry. Manufactures include: watches, automobiles, leather goods, engineering products, and flour. There are large railway repair-shops. Pop. 59,200. (4) A city of Missouri, the county seat of Greene county, in the Ozark Mountains. Flour, carriages, and wagons are made. There are railway repair-shops. Pop. 40,000.

Spring-tails, a family of wingless insects belonging to the order Aptera, sub-order Collembola, and distinguished by the possession of an elastic forked caudal appendage which is folded under the body when at rest. By the sudden extension of these 'tails' they are enabled to make considerable leaps.

Spruce, the name given to several species of trees of the genera Picea and Tsuga. The Norway spruce is *P. excelsa*, which yields the valuable timber commonly known as white or Christiania deal. It is a native of great part of Northern Europe, and is a tree of conical habit of growth, reaching sometimes the height of 150 feet. The white spruce is *P. alba*, the black spruce-fir is *P. nigra*, both natives of North America. The latter attains the height of 70 or 80 feet, with a diameter of from 15 to 20 inches. Its timber is of great value on account of its strength, lightness, and elasticity, and is often employed for the yards of ships and the sides of ladders. From the young shoots is extracted the *essence of spruce*, a decoction used in making spruce beer. The hemlock spruce is the *Tsuga canadensis*, a noble species, rising to the height of 70 or 80 feet, and measuring from 2 to 3 feet in diameter. It grows abundantly over great part of Canada and part of the United States. The wood is employed for laths, fences, coarse indoor work, &c. The bark is exceedingly valuable for tanning. Douglas's spruce or fir, the *Pseudotsuga Douglasii* of North-Western America, reaches a height of 100 to 180 feet in its native forests, and has been introduced into Britain as an ornamental tree. It is the most important timber tree in the western United States, where it is often called red fir, or Oregon pine.

Spun-yarn, a small line or cord, formed of two, three, or more rope-yarns twisted together. The yarns are usually drawn out of the strands of old cables, and knotted together. Spun-yarn is used for various purposes, as serving ropes, weaving mats, &c. The name is also used for any kind of yarn in which in the last stage of manufacture a spinning-machine has been employed. Spun-yarn is thus distinct from rove-yarn and the like.

Spurge, the common name of the different species of British plants of the genus Euphorbia. They abound with an acrid, milky juice. The caper-spurge is the *E. Lathyris*, the oil of the seeds of which is a substitute for croton-oil; the cypress spurge is the *E. Cyparissias*, a virulent poison; the petty spurge is the *E. Peplus*, once used as a powerful purgative. See *Euphorbiaceæ.*

Sun Spurge (*Euphorbia Helioscopia*)

Spurgeon (spur′jn), Charles Haddon, British preacher, born 1834, died 1892. He accepted the pastorate of a small Baptist congregation at Waterbeach when he was only eighteen; removed from thence in 1853 to a chapel in New Park Street, Southwark, which, becoming too small for his audience, required him to engage the Surrey Music Hall, and ultimately to build, in 1861, the Metropolitan Tabernacle. For over thirty years he was the most popular preacher in Britain, and preached regularly to congregations of many thousands. His sermons were taken down in shorthand, and distributed in pamphlet form in enormous editions. Besides his ordinary ministrations, and the publication of a weekly sermon, he founded the Pastors' College, the Stockwell Orphanage, the Colportage Association, a Book Fund, Supplementary Pastors' Aid Fund, almshouses, schools, &c. In 1887 he severed his connection with the Baptist Union as a protest against what he called 'the down grade' tendency of the Church, especially in its attitude towards the Bible. His publications include: *The Saint and his Saviour*, *Feathers for Arrows*, *The Metropolitan Tabernacle*, *Farm Sermons*, and *Salt Cellars*.—BIBLIOGRAPHY: J. J. Ellis, *Charles Haddon Spurgeon*; W. Y. Fullerton, *C. H. Spurgeon: a Biography.*

Spurrey, the common name for Spergula, a genus of plants, nat. ord. Caryophyllaceæ. The species are found in fields and cultivated ground, especially on sandy soils, all over the world. They have slender stems, very narrow often whorled leaves, and small white fine-petalled flowers. *S. arvensis* (corn-spurrey or yarr) is a well-known plant, growing in corn-fields. In some parts of Europe it is sown as fodder. Cattle and sheep are fond of it; hens also eat it, and are said to lay a greater number of eggs in consequence.

Spur-royal, a gold coin, first struck in the reign of Edward IV. In the reign of James I its value was 15*s*. It was so named from having on the reverse a sun with four cardinal rays, not unlike the rowel of a spur, issuing from it.

Spur-wing, the English name for plover-like birds of the family Parridæ, having the wing armed with a bony spur. The South American forms (*Parra jacana*, &c.) are known as jacanas, while others are native to Africa, Southern Asia, the East Indies, and Australia. The name is also given to the species of geese of the genus Plectroptĕrus. They are natives of Africa, and have two strong spurs on the shoulder of the wing.

Spy. See *Espionage.*

Squadron, the principal subdivision of a regiment of cavalry. Each regiment is composed of H.Q. Wing and three squadrons. A squadron consists of Squadron H.Q., three sabre troops, and one Hotchkiss-gun troop. With each squadron there are 6 officers and 146 other ranks. Of the officers a major and a captain serve with Squadron H.Q., and one subaltern with each troop. The term is applied also to a division of a fleet, being a detachment of ships of war employed on a particular service or station, and under the command of a commodore or junior flag-officer.

Squama′ta, the division of reptiles comprising the Ophidia (snakes) and Lacertilia (lizards), in which the integument develops horny scales, but there are no dermal ossifications.

Squamipen′nes, a family of acanthopterygious (teleostean) fishes, so named on account of their fins being covered with scales, not only on the parts which have soft rays, but frequently also on those that have spinous ones. They are chiefly small fishes, abundant in the seas of hot climates, and of the most beautiful colours. They frequent rocky shores, and their flesh is, generally speaking, very wholesome and palatable. Called also *Chætodontidæ.*

Squares, Method of Least. When several observations or sets of observations are made to determine the magnitude of a quantity, such as a length, an angle, or an interval of time, it is usually found that the results do not agree exactly, even after all the corrections due to known sources of error have been made, including the 'personal errors' of the observer. The question arises of what is the most probable value of the quantity to be determined (see *Errors of Observation*). The simplest case is when the quantity is directly measured a number of times by the same method, or by methods likely to give results equally close to the true value, in which case the arithmetic mean of the observed values may be taken as the most probable value. It is easy to show that the sum of the squares of the differences between the observed values and this mean value is less than it would be if any other mean value were taken. Thus if $x_1, x_2, \ldots x_n$ are the observed values, we get the most probable value x by applying the rule that $(x_1 - x)^2 + (x_2 - x)^2 + \ldots + (x_n - x)^2$ should be a minimum. It was shown by Gauss that the same rule can be applied to more complex cases of combinations of observations. He established the rule by reasoning based on his Law of Error (see *Probability*), and developed arithmetical methods for applying the rule in various cases. A very common case is when a number of sets of direct observations of the same quantity are made, each set having a different value for h, its *precision* (see *Probability*). The result of applying the rule in this case is that a different *weight* (proportional to h^2) must be attached to the mean of each set, so that if $z_1, z_2, \ldots z_n$ are these means, the final mean will be $(h_1^2z_1 + h_2^2z_2 + \ldots + h_n^2z_n) \div (h_1^2 + h_2^2 + \ldots + h_n^2)$. Another more complicated case is where the values of two or more quantities have to be deduced from a number of observations of quantities related to them. Here each observation will give rise to an equation involving the unknown quantities to be determined, and the number of such equations will usually far exceed the number of unknowns. The method of applying the rule of *least squares* to such cases, and of calculating the probable error of the result, is described in treatises on the method of least squares.—Cf. M. Merriman, *Elements of the Method of Least Squares.*

Squaring the Circle. The problem of finding a square equal in area to a given circle, or the essentially equivalent problem of finding a straight line equal in length to a given circumference, has attracted attention from very early times. If the ratio of circumference to diameter is denoted, as it has been since the days of Euler, by the symbol π, then circumference $= 2\pi r$, and area $= \pi r^2$. The roughest measurement shows that π is about 3, and even at the present day the idea that it is exactly 3 is not uncommon. Archimedes proved that it lies between $3\frac{1}{7}$ and $3\frac{10}{71}$, a notable result which was not improved on for centuries. The value 355/113 was given in 1527 by Adrian of Metz. It is correct to 7 significant figures, but Adrian's proof was inadequate. The advance in methods of computation, and especially the introduction of infinite series, made it possible from about the time of Newton to carry the calculation to any length that might be desired. The simplest formula for π is given by Gregory's series (see *Function*), viz. $\pi = 4(1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots)$, the number of terms being infinite; but many far more convenient series are available. By one of these the value was calculated by W. Shanks in 1873 to 707 decimal places. To 20 places, $\pi = 3{\cdot}14159265358979323846$.

Circle-squarers have usually looked at the problem from the graphical or geometrical rather than from the arithmetical point of view. The problem which they have set themselves is to find a right line equal to a given circumference, restricting themselves to the methods of Euclid, and debarring all instruments except ruler and compasses. It is only quite recently that it has been completely shown that this problem has no solution. It had been proved by J. H. Lambert in 1761 that π is irrational (see *Number*), but this is not enough. In order that it may be possible to draw a line representing π by Euclid's methods, it is necessary and sufficient that π be capable of representation by some combination of square roots of whole numbers. This would imply that π is a root of a rational integral equation of even degree, with rational coefficients; and it has been proved by F. Lindemann and others, following a method due to Hermite, that this cannot be the case.—Cf. A. de Morgan, *Budget of Paradoxes.*

Squash, a plant of the genus Cucurbita (*C. Melopepo*) and its fruit, cultivated in America as an article of food. The name is also given to other species. See *Gourd.*

Squaw-root, a singular scaly plant (*Conopholis americana*, nat. ord. Orobancheæ), a native of America, found growing in clusters among fallen leaves in oak woods.

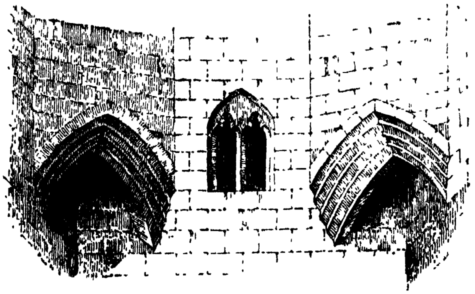
Squeteague (skwe-tēg′), an American fish, the *Otolithus regālis* of Cuvier, very common in the waters of Long Island Sound and adjacent bays, where it is captured in large quantities for the table. It produces a dull sound like that of a drum.

Squid, a popular name of certain cuttle-fishes belonging to the dibranchiate group of the class Cephalopoda, and included in several genera, of which the most familiar is that of the calamaries (Loligo). See *Calamary*.

Squill, a plant of the genus Scilla, nat. ord. Liliaceæ, nearly allied to the hyacinths, onions, &c. Two species are indigenous to Britain—*S. verna*, very abundant on the cliffs of Cornwall, and frequent also in the Orkney and Shetland Isles, and *S. autumnālis*, which grows also in Cornwall and in other parts of England, not being confined to the sea-shore. The term squill is more particularly applied to the *Scilla maritima* (*Urginea Scilla*), officinal squill or sea-onion, which has a large acrid bulbous root like an onion. It is a native of the sandy shores of the Mediterranean. The bulb has been known as a medicine from the earliest ages, and is still used as a diuretic and expectorant. In large doses it causes vomiting and purging, and may even prove fatally poisonous.

Squilla, a genus of crustaceans, order Stomatopoda, the type of the family Squillidæ, having the body long and semi-cylindric, somewhat resembling that of a lobster. The shell consists of a single shield of an elongated quadrilateral form, covering the head, the antennæ and eyes excepted, which are placed on a common anterior articulation. The best known of the numerous species is the locust shrimp, mantis-crab, or mantis-shrimp (*S. mantis*) of the Mediterranean.

Squinch, or **Sconce**, in architecture, a small pendentive arch (or several combined) formed across an angle, as in a square tower to support the side of a superimposed octagon.



Squinch, Salisbury Cathedral, A.D. 1300

Squint, in architecture, an oblique opening passing through the walls of many old churches, usually constructed for the purpose of enabling a person in the transepts or aisles to see the elevation of the host at the high altar. Generally they are not above 1 yard high and 2 feet wide, but sometimes they form narrow arches 10 or 12 feet in height, as at Minster-Lovell, Oxfordshire. The name *hagioscope* is sometimes applied to them.

Squinting, or **Strabismus**, a defect of the eyes owing to which they cannot both be brought to bear upon the same object at once. It is usually due to one of the lateral muscles of the eye having a longer pull than the other. It may also arise from paralysis of one muscle caused by a blow. There are several kinds of squint, the two chief being inward or convergent and outward or divergent, the axes of the eyes in the one case tending to meet, in the other to separate. For persons so affected, and especially children, it is well not to look too long at small objects or read in ill-lighted rooms, and glasses to correct the sight should be obtained. It is also a good thing to have the sound eye (when there is but one squinting eye) bandaged up for a short time each day. When these measures fail the muscle can be lengthened by means of a simple surgical operation.

Squirrel, a small rodent mammal of the family Sciuridæ, the type of which is the genus Sciūrus, or true squirrels. This family comprehends three groups—the true squirrels (Sciūrus),

Squirrels. Common British Squirrel (*Sciūrus vulgāris*) and Chipmunk (*Tamias striatus*) the ground-squirrels (Tamias), and the flying-squirrels (Pterŏmys and Sciuroptĕrus). The true squirrels are distinguished by their strongly compressed inferior incisors and by their long bushy tail. They have four toes before and five behind. The thumb of the fore-foot is sometimes marked by a tubercle. They have in all four grinders, variously tuberculated, and a very small additional one above in front, which very soon falls. In colour they are usually of a rich ruddy brown on the upper parts, merging into reddish or greyish-white on the under parts of the body; but the fur varies with the season and climate, so that in winter it may be of a grey appearance. The head is large, and the eyes projecting and lively. Several species are enumerated, as the common squirrel, which inhabits Europe and the north of Asia; while the cat-squirrel, grey squirrel, black squirrel, red squirrel, and the great-tailed squirrel are American species. The common British squirrel (*Sciūrus vulgāris*) and several other species are remarkably nimble, running up trees and leaping from branch to branch with surprising agility. They subsist on nuts, acorns, seeds, &c., of which they lay up a store for winter, some of them in hollow trees, others in the earth. Their nest, which consists of woody fibre, leaves, and moss, is usually situated in a fork of a tree, and the young, of which there are three or four, are born in June. When engaged in eating, they sit on their haunches with their tail thrown upwards on the back, grasp the eatables with their fore-paws, and gnaw with their powerful teeth. The fur of some of the American species is an article of commerce. See *Ground-squirrel*; *Flying-squirrel.*

Squirrel-monkey, a monkey of the genus Chrysothrix, inhabiting Brazil, resembling in general appearance and size the familiar squirrel. A well-known species is the *C. sciurea*, which is coloured greyish-olive, the under surface being grey, the ears white, and the tail tipped with black.

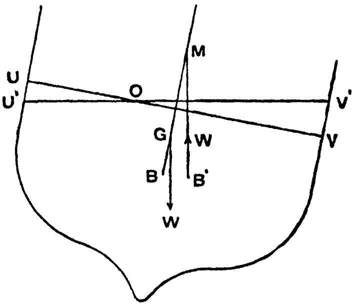
Squirting-cucumber, one of the popular names of the fruit of *Ecballium agreste*, a plant of the gourd family inhabiting Europe, which, when nearly ripe, separates suddenly from the peduncle, at the same time ejecting its juices and seed. See *Elaterium; Dispersal of Seeds.*

Srinagar, a city, the capital of the state of Kashmir, in the Western Himâlaya, situated in the valley of Kashmir, on both banks of the Jhelum. It extends along the river for about 2 miles. Srinagar has manufactures of shawls, paper, leather, fire-arms, otto of roses, &c. Pop. (1921), 141,631.

Stability, a word used in a technical sense to denote a certain permanence in the state of a body or system (see *Statics*, section on *Stability of Equilibrium*). One example of dynamic stability is the motion of a top. If the top is spinning with its axis either vertical or sweeping out a right circular cone round the vertical, a slight impulse will cause the top to *nod*, but the axis will never move far from its position in the steady state. The nutation of the earth's axis is another case in point. An outstanding instance of stability on a great scale is shown in the motions of the solar system, and one of the chief problems of dynamical astronomy is the determination of the conditions for the stable motion of mutually attracting bodies. A thermodynamical condition for the stable equilibrium of any chemical or physical system is that the entropy (q.v.) should be a maximum subject to constancy of the energy. The great name in this part of the subject is that of J. Willard Gibbs (1839–1903), who for over thirty years was professor of mathematical physics in Yale University, and in 1901 was awarded the Copley medal of the Royal Society. See *Solution*; *Stability of Ships.*

Stability of Ships. The stability or instability of a vessel floating in a position of equilibrium (see *Hydrostatics*) is determined by the position of the *metacentre.* Any small displacement of the floating body may be taken as compounded of (1) a vertical displacement, (2) a horizontal displacement, (3) a rotation about a vertical axis, (4) a rotation about an axis in the plane of flotation, passing through O, its geometrical centre of gravity; the *plane of flotation* of a body partially immersed in a liquid being defined to be the plane area bounded by the line where the surface of the body meets the surface of the liquid. The equilibrium for displacement of type (1) is stable; for that of types (2) and (3) neutral; for (4) it will be proved to be stable or unstable according as the metacentre, M, of the body is above or below G, its centre of gravity.

The diagram is a vertical section of the floating body by a plane perpendicular to the axis of angular displacement, which passes through O, the body being slightly displaced. UV is the section of the plane of flotation for the equilibrium position, and B the centre of buoyancy, both supposed to be marked on the body, and U′V′, B′ the same in the displaced position. The vertical through B′ and the line through B perpendicular to UV intersect in a point M, which is the *metacentre.* Since BM is vertical when the body is in the position of equilibrium, G must lie in it. Hence in the displaced position the forces on the body are equivalent to its weight, W, acting downwards at G, and an equal upward force W (the buoyancy) acting at B′. It is obvious that this ‘couple’ will tend to right the vessel if G is below M, but to make it heel over farther if M is below G. Hence the condition for stability stated above. The position of M is determined by the equation BM × V = I, where V is the volume of the fluid displaced, and I is the 'second moment' of the 'plane of flotation', about the axis of rotation. This construction holds good only if this axis is a 'principal axis' of the plane of flotation. If otherwise, the point B′ will not be in the plane of this figure, and the vertical through B′ will not intersect BG or BG produced. Such a displacement can be resolved into two small rotations, one about each of the principal axes of the plane of flotation. Each of these component rotations will have its own metacentre. In the case of a vessel of ordinary symmetrical shape, symmetrically loaded, the principal axes are the axis of symmetry of the 'plane of flotation' and an axis at right angles to it, passing through O, one corresponding to *rolling* and the other to *pitching* displacements. The M for the latter is much higher than that for the former, hence practically only the former need be considered. GM is the *metacentric height*. The greater GM, the greater is the stability, also the greater is the rapidity of rolling. Hence, to avoid violent rolling, only a moderate metacentric height is preferred.



Note that a body floating wholly submerged (e.g. a submarine) has no metacentre, the centre of buoyancy, B, being a fixed point in the body.

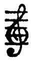
Stachys (stak′is), a genus of plants belonging to the nat. ord. Labiatæ. The species are very numerous, and are widely distributed through the temperate regions of the globe. Four species are British, and are known under the name of *woundwort*.

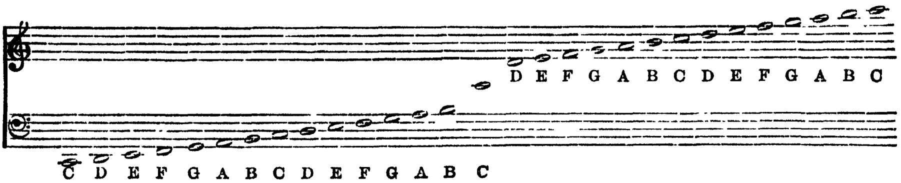
Stade, a town of Prussia, in the province of Hanover, on the Schwinge. The Stade dues, a toll charged on all cargoes shipped to Hamburg, were levied there until 1861. Pop. 11,078.

Stadium (Gr. *stadion*, furlong, standard of length), in ancient Greece, a course set apart for foot-races and other athletic contests, especially the course at Olympia, in Elis. The Olympian stadium was rectangular, but most stadia had one end semicircular. The length of the part marked off for the race was always 600 feet, but the foot varied. The Olympian course had a length of about 681 English feet.

Staël - Holstein, Anne Louise Germaine Necker, Baroness de, French writer. The only child of Necker, banker and Minister of Finance to Louis XVI, she was born in 1766, and died in 1817. In 1786 she married Baron de Staël-Holstein, Swedish Ambassador at the French court. The marriage was not very happy, and she lived for a time apart from her husband. In 1788 she published her *Lettres sur les écrits et le caractère de J. J. Rousseau.* At the outbreak of the Revolution (1789) she exercised considerable political power; but during the Reign of Terror she fled to Coppet (1792), her father's estate in Switzerland. In 1793 she sought refuge in England, where she published *Reflections on the Trial of the Queen* and *Reflections on the Peace.* During the Directory Madame de Staël-Holstein returned to Paris, where she published the novels *Delphine* (1802) and *Corinne* (1807). These novels and *De l'Allemagne* are her best-known works. The attempt to publish *De l'Allemagne* in Paris led to her exile by Napoleon, with whom she had never been on friendly terms.—Bibliography: M. Norris, *Life and Times of Madame de Staël*; A. C. P. Haggard, *Mme de Staël: her Trials and Triumphs.*

Staff, in music. The method of classifying musical tones and arranging them in scales according to their pitch has been explained in the articles *Acoustics*; *Octave*; *Pitch*; *Scale*. The history of the arts of musical composition and performance has been discussed under *Music*. The present article deals with the link between the composer and the singer or player—the method of representing musical tones by notes on a written or printed page. (Only the *staff notation* is explained—see *Tonic Sol-fa Notation*.)

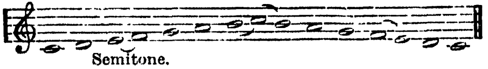
Every sound employed in the art of music is represented by characters called notes on a *staff*—that is, five equidistant horizontal lines on or between which the notes are placed. A note represents a higher or a lower sound according as it is placed higher or lower on the staff. When any note is higher or lower in pitch than can be placed upon the staff, short lines called *ledger-lines* are added above or below the staff to indicate the relation of the note to those on the staff. As, however, the multiplication of ledger-lines is liable to become embarrassing to the eye, musicians have endeavoured to overcome the difficulty by the use of more than one staff. The staves are the *bass*, *mean*, and the *treble*, but the second is now seldom used. The treble staff, which contains the upper notes, is distinguished by a character called a G or treble *clef*  the bass by a character called the F or bass clef and the mean by a character called the C or mean clef The treble and bass clefs only are required for keyed instruments of the pianoforte kind, and when a staff is wanted for each hand they are joined by a brace, the upper staff carrying the notes generally played by the right hand and the lower those played generally by the left, as follows:



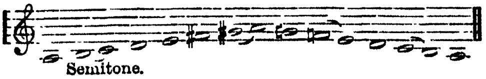
It will be seen that the steps in every diatonic scale must correspond to those of the scale of C, in that the notes composing it stand in the same fixed ratio to the key-note of the scale. In selecting another key-note than C, however, it is necessary to modify some of the natural notes by the insertion of what are called *sharps* and *flats*, in order to preserve the required relation and sequence of the intervals (the tones and semitones in their due relative positions) and so produce the major musical progression. The sharp (♯) placed before a note raises the pitch by a semitone, the flat (♭) lowers it by a semitone. A sharp or flat placed at the beginning of a staff affects every note upon the line which it dominates, unless the contrary be indicated by the sign of the *natural* (♮), which restores the note to which it is attached to its normal pitch. In the model diatonic scale given it has been pointed out that there is an interval of a tone between every note, except the 3rd and 4th (E and F) and 7th and 8th (B and C), when the interval consists of a semitone. Now if we wish to make G the key-note, it is clear that without some contrivance the notation of the scale from G to its octave would throw one of the semitones out of its place—namely, that between E and F, which, instead of being, as it ought to be, between the seventh and eighth, is between the sixth and seventh. It is obvious, then, that if we raise the F a semitone, we shall restore the interval of the semitone to a position similar to that which it held in the key of C. If D be taken as a key-note, we shall find it necessary to sharpen the C as well as the F in order to bring the semitones into their proper places. Still proceeding by fifths, and taking A as a key-note, a third sharp is wanted to raise G. We may proceed thus till we reach the scale of C sharp, with seven sharps, which is, however, rarely used. This series of scales with sharps is obtained by taking the dominant, first of the model scale, and then of the others in succession, as the key-note, and sharpening the fourth of the original scales to make it the seventh of the new. Another series is obtained by taking the subdominant of the model scale as the key-note and lowering its seventh a semitone, making it the fourth of the new scale, or scale of F. Taking the subdominant of the scale (B) as the key-note, we require to flatten the E in addition to the B, and so on until we have lowered all the tones in the scale a semitone.

Besides the forms of the diatonic scale, which has an interval of two tones between the tonic and the third, and is called the *major scale*, there are *minor scales* of which the most important kind has an interval of a tone and semitone between its tonic and third, the seventh note being sharpened so as to form a leading note. In the ascending scale, too, the harsh interval of the second between this leading note and the one immediately below it is frequently avoided by sharpening the lower note. In the descending scale the sharps are removed, and the scale is identical with the major, beginning at its sixth and descending an octave. See the example shown.

Major Scale of C.



Minor Scale of A.

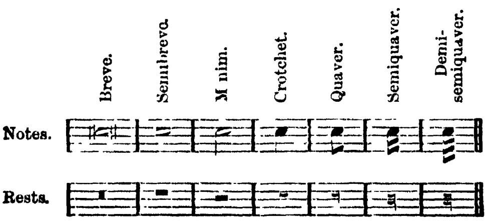


Major and minor scales which, like those given in the example, have the same key signature are called *relative*. Thus the major scale of G has for its relative minor the scale of E minor; the major scale of D has for its relative minor the scale of B minor; and so on. Each minor scale is also called the tonic minor to the major scale on the same key-note. The tonic minor scale to C major is C minor. One major scale is also said to be related to another when it is raised from its dominant or its subdominant; thus the scales of G and F are held to be nearly related to that of C.

There is still another kind of scale, called the *chromatic* (Gr. *chrōma*, colour), because, like colours in painting, it embellishes the diatonic by its semitones. It consists of thirteen notes, and usually ascends by sharps and descends by flats.

Intervals in music (i.e. the distance from any one note to any other) are reckoned always upwards and inclusively by the number of names of notes they contain, both limits to the interval being counted. Thus C to E is a third, both C and E being counted in the interval. They are known as major or normal when they are such as would be found in any major scale; as minor when the interval consists of a semitone less than the corresponding major interval; as augmented when consisting of a semitone more than major; as diminished when a semitone less than minor; and as simple or compound according as they fall within or exceed the compass of an octave.

Hitherto notes have been referred to only as representatives of the various sounds with reference to their pitch and distances from each other; but each note serves also to mark the relative duration of the sound it represents. The following are the names and forms of the notes commonly in use, each in succession being half the duration of the note preceding it:



The stems of the notes may be written upwards or downwards as convenient. In connection with these notes, other signs are used still further to indicate duration. A dot placed after a note lengthens it by one-half, two dots by three-fourths. Instead of the dot a note of its value may be written, and a curve, called a *tie*, written over it and the preceding note. Sometimes three notes of equal value have to be played in the time of two, in which case the figure 3 with a curve thrown over it is written above or below the notes. Two *triplets* (as this group is called) may be joined, and the figure 6 surmounted by a curve written over them; they are then performed in the time of four notes of the same form. A sensible interval of time often occurs between the sounding of two notes; this is represented by characters called *rests*, each note having a corresponding rest. A dot may be added to a rest in the same manner as to a note, to indicate an addition of a half to its length. See the example just given, which shows the rests in connection with their corresponding notes.

Every piece of music is divided into portions equal in time, called *measures*, which are separated from each other by vertical lines, called *bars*. The term bar is often loosely applied to the measure as well as to the line. The exact length of the measure is indicated by a sign at the beginning of the piece of music. In common time, indicated by a 𝄴 written after the clef, each measure contains a semibreve, or such notes and rests as make up together its value. Another form of common time, marked with a 𝄵 contains two semibreves in the measure, or their equivalents in minims, crotchets, &c. Another method of indicating time (or rather more correctly, rhythm) is by figures, in the form of a fraction. The figures of the denominator are either 2, 4, 8, or 16, which (the semibreve being considered the unit) stand for minims, crotchets, quavers, and semiquavers respectively; and the numerator shows the number of these fractional parts of a semibreve in the measure. Besides common time, which may be indicated in two ways, there is triple time, in which a measure is made up of three minims, crotchets, or quavers, which can only be marked by figures; these are $\frac{3}{2}$, $\frac{3}{4}$, or $\frac{3}{8}$. When two or four measures of triple time are united in one measure, the music is said to be written in compound common time, and is indicated by the fractions $\frac{6}{4}$ and $\frac{6}{8}$; rarer examples of compound time signatures are $\frac{9}{4}$, $\frac{9}{8}$, $\frac{9}{16}$, $\frac{12}{8}$, &c. The object of the division of musical passages into measures is to indicate their rhythm. Notes, like words or syllables, are *accented* or *unaccented*. The strongest accent is given to the first note of a measure. In common time of four notes to the measure the third has a subordinate accent, as, though in a less degree, the third measure note in triple time. In compound common time the subordinate accents fall on the first note of the last half of the measure, and in compound triple time on the first note of each of the groups of three of which the measure is composed. When a curve is placed over two notes in the same degree, but not in the same bar, the two notes are played as one of the length of both, and the first note acquires the accent. This displacement of the accent is called *syncopation*. If the curve is written over notes of different degrees, it is called a *slur*, and indicates that the notes are to be played or sung smoothly, as if gliding into each other. When an opposite effect is wanted, that is, when the notes are to be produced distinct and detached (*staccato*), a dot is placed over them. The various degrees of loudness and softness which occur in a piece of music are indicated by such Italian words as *forte*, loud; *fortissimo*, very loud; *piano*, soft; *pianissimo*, very soft.

In order to save time in writing music various abbreviations are used.

Melody is a particular succession of sounds in a single part, and is produced by the voice or by an instrument. A melody generally consists of an even number of phrases; this number may be four, eight, twelve, or sixteen. A phrase generally corresponds to a line in a verse of poetry. In order to produce an agreeable variety, a melody may pass from the form of the scale in which it started to another, generally to the one most nearly related to it, that of the dominant or subdominant. This change from one key into another is called *modulation.* Except in very rare cases, a melody ends on its key-note. A musical composition may consist of a series or progression of sounds so connected that several of them may be heard at the same moment. When several voices or instruments produce at the same instant sounds different in pitch, and so combined as to cause a sensation agreeable to the ear, the combination is called *harmonious,* and the proper method of combining these sounds is called the art of *harmony.* The series of notes taken by a single voice or instrument capable of producing only one note at a time is called a *part.* Four parts are by far the most common; but five, six, seven, eight, and even more numerous parts are common in the ecclesiastical compositions and madrigals of the old masters. When two sounds heard together are agreeable to the ear, they are called *concordant,* or are said to form a *concord;* if, on the contrary, they grate upon the ear, they are said to be *discordant,* or to form a *discord.* Concords are of two kinds—perfect and imperfect. The perfect are the minor fourth, the perfect fifth, and the octave; the imperfect are the major and minor third, and the major and minor sixth. A perfect concord is so called because its conterminate sounds cannot be raised or depressed without becoming discordant. If three or more sounds be heard at the same time, the combination is called a *chord.* When a chord is composed of concords only, or in other words when it is composed of a fundamental sound accompanied by its third (major or minor) and its fifth, it is termed a common chord. Of discords the most simple is the minor seventh, or, as it is usually called, the dominant seventh. The different motions of the parts which constitute harmony may be *parallel, direct* (or *similar*), *oblique,* and *contrary.* Parallel motion is when two or more parts move in the same direction and remain at the same number of degrees distant; direct or similar motion is when the parts move in the same direction but do not remain at the same distance; in oblique motion, either part may be stationary while the rest move in parallel or contrary directions; contrary motion is when the parts approach or recede from each other. It rarely happens that all the parts can move in the same way upwards or downwards together. The rules generally given with respect to the motion and succession of concords are: (1) Octaves and fifths must not be consecutive in parallel motion. (2) Unnecessary and distant skips should be avoided as much as possible, and the chords should be as close and connected as may be. (3) The regular motion of the different parts must be observed: sharp intervals should ascend after the sharp, whilst flat intervals should descend after the flat. A piece of music harmonized throughout by concords would prove too cloying, and to prevent this discords are introduced. Certain discords are very disagreeable if produced abruptly without preparing the ear to receive them. The preparation of a discord is effected by taking care that the discordant note is heard in the preceding consonance. As the ear would not tolerate a long succession of discords, it must be satisfied by a return to concords, which is called the resolution of a discord. This is effected by the part in which the discord appears moving upward or downward to the concordant note in the next chord.

Staff, officers appointed to the head-quarters of a commander to assist him. The British *Field Service Regulations* explain the rôle of the staff in the following general terms: "An officer of the staff, as such, is vested with no military command, but he has a two-fold responsibility: first he assists a commander in the supervision and control of the operations and requirements of the troops, he transmits his orders and instructions and arranges details connected therewith; secondly, it is his duty to give to the troops every assistance in his power in carrying out the instructions issued to them." In the British army the staff is divided into three main branches: (1) the General Staff, (2) the Adjutant-General's Branch, (3) the Quartermaster-General's Branch. Of these the General Staff, as the term is understood now, is of quite modern date, while the other two branches were in existence late in the eighteenth century.

Broadly speaking, the General Staff is charged with all questions of military operations and plans for concentration; the acquisition of information about military affairs in foreign countries (see *Reconnaissance*); the sifting and distribution of information; and in peace time, the main lines on which the training of troops is to proceed.

At the head of the General Staff is the Chief of the Imperial General Staff, other officers being known as General Staff officers of various grades, and wearing as a distinctive mark the letter 'G' on an armlet which may be either French-grey, red, or a combination of red and black, according to the formation with which they are serving; thus a French-grey armlet with the letter 'G' signifies that the wearer is serving at the War Office in the General Staff Branch. The old familiar scarlet gorget patches formerly worn by all staff officers are now confined to the use of field-marshals, general officers, and colonels on the staff.

The Adjutant-General's Branch deals with, among other subjects, discipline, military law, personnel, interior economy, honours and rewards, and routine duties. An officer of this branch is either a deputy, an assistant, or a deputy-assistant adjutant-general. He also wears the armlet already mentioned, with the qualifying letter 'A'.

The Quartermaster-General's Branch includes duties connected with embarkation, quarters, supplies, clothing and stores, and transport. Their titles follow the same system as above, and their armlets are marked with a 'Q'. A brigade-major is the staff officer of a brigade, and to a certain extent combines the duties of all three branches. He wears a blue armlet marked 'B.M.'

Staff College, an establishment at which officers of the army are trained in the higher branches of the art of war, in order to fit them to hold commands in the field and to fill positions on the staff (q.v.).

The Staff College, Camberley, built on the estate at Sandhurst, purchased in 1801 as the site of the Royal Military College (which was moved from High Wycombe and Great Marlow in 1812), was opened in 1862. The course at the Staff College is normally two years. The entrance examination, which is very difficult, is competitive to a certain extent; that is to say, there are some thirty vacancies offered to competition, while other vacancies are reserved for nomination, the nominee having to attain a certain standard in the examination. Nominations are allotted proportionately to the various arms, i.e. so many for cavalry and infantry, so many for Royal Artillery, and so on. In addition, certain nominations are given to officers of troops of the self-governing dominions, to the Indian army, to the Royal Air Force, and, by a system of exchange, to the navy. This system ensures the interchange and dissemination of ideas throughout the empire.

There is also a Staff College at Quetta, India, where the organization and course of study is identical with that of Camberley, and of which the certificate bears exactly the same value. The fact of an officer having graduated at the Staff College is shown in the Army List by the letters *p.s.c.* after his name.

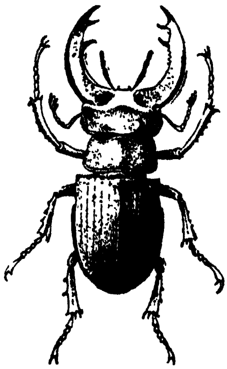
Staffa, an island of the Inner Hebrides, in Argyllshire, some 6 miles north of Iona, 7 miles from the nearest point of Mull, and about 55 miles west of Oban by steamer; 1½ miles in circuit; greatest height, 144 feet. The island is best known for its precipitous basaltic cliffs rising in columnar form, and its caves. The largest of these, Fingal's, or the Great Cave, has an entrance 66 feet high at mean tide, a breadth of 42 feet at entrance, and extends backwards 227 feet. Its sides are composed of basaltic columns, from the roof hang clusters of short columns whitened by calcareous stalactites, while the floor is covered by the sea to the depth of 18 feet at the entrance.

Stafford, a municipal, and until 1918 a parliamentary, borough of England, the county town of Staffordshire, on the River Sow. The principal industries are the making of boots and shoes, tanning, and engineering. Pop. (1921), 28,600.

Staffordshire, one of the central counties of England, bounded by Cheshire, Derbyshire, Warwickshire, Worcestershire, and Shropshire; area, 1171 sq. miles. The surface in the north consists chiefly of wild moorlands, rising in several parts more than 1000 feet above sea-level, while the midland and southern parts consist for the most part of level and fertile lands. The Trent, with its tributaries the Sow, Tame, Blythe, and Dove, traverses the county. There are two valuable coal-fields—one in the north called the Pottery coal-field, and the other in the south, usually known as the Dudley coal-field. The chief industries are coal-mining, iron-ore mining, smelting, and manufacturing, and North Staffordshire is the chief centre in the kingdom for the various earthenware manufactures. The county is well supplied with railways and canals. The principal towns are Stafford, Lichfield, Walsall, Wolverhampton, Burton-on-Trent, Stoke-on-Trent, West Bromwich, Wednesbury, Longton, Hanley, Burslem, and Newcastle-under-Lyme. Pop. (1921), 1,349,225.

Stag, or **Red-deer**, a large and handsome deer (*Cervus elăphus*) which is a native of Europe and Northern Asia, and in Britain is now found wild only in the Highlands of Scotland. In summer the back and flanks of the stag are of a reddish-brown colour, while these parts in winter are grey-brown. A full-sized male stag with antlers well developed stands about 4 feet high at the shoulder, and has horns 3 feet in length, while the female is smaller and has no horns. They feed on grass, buds, and young shoots of trees, and in winter they roam in herds. The pairing season occurs in August, and the calf is dropped in May. The male is known distinctively as the hart (or stag), the female as the hind.

Stag-beetle, a name of lamellicorn beetles of the genus Lucānus, family Lucanidæ. The common stag-beetle (*Lucānus cervus*) is one of the largest of British insects, and is especially distinguished by the enormous size of the horny and toothed mandibles in the males. It is common in some localities in the neighbourhood of London, and is often 2 inches long, of a black colour.



Stag-beetle (*Lucānus cervus*)

Stage (O.Fr. *estage*, from Lat. *stare*, to stand) is the raised platform on which theatrical performances are given. The earliest European stage, that of the ancient Greeks, was not a platform, but the circular flat surface (*orchestra*), almost always of beaten earth, on which the choric dances in worship of Dionysus were performed. Little by little the dancing was supplemented, and finally superseded, by acting; and to the *orchestra* was added a raised platform. The actors needed also dressing- and waiting-rooms, and these were provided in a *skēnē* or tent (whence our word 'scene') placed at or near that part of the circumference of the *orchestra* where there were no spectators (see *Theatre*). The nature, even the very existence, of the platform in classical Greek times has been hotly disputed, some German scholars maintaining that there was no platform in the days of Æschylus, Sophocles, and Euripides, but that all the action, dramatic and choric, took place in the *orchestra* round the altar of Dionysus, which could figure as a rock, a tree, or anything that was needed. The best English scholars incline to the belief that in the fifth and fourth centuries B.C. there was already at the theatre of Dionysus at Athens a low, rectangular stage, 60 to 70 feet from side to side and about 15 feet from back to front, with wings projecting forward, all built of wood, at the back of which stood the *skēnē*, also built of wood, perhaps two stories high, and forming the background of the stage during performances of plays. This gave place in the second and first centuries B.C. to a stone structure, about 18 feet high, bearing a wooden platform, 9 or 10 feet from back to front, connected with the *orchestra*, if at all, by temporarily placed flights of steps. At the back of the stage stood the *proscenium* (the building in front of the *skēnē*), appearing as an architectural background of pillars, built of stone and perhaps sumptuously decorated, with a central door and two side entrances on to the stage. In days when the chorus was reduced to a mere accessory to the play, and there was no great need for quick communication between chorus and actors, this high and shallow stage would give a good view to the majority of the audience on the hill-side. Details varied in different Greek theatres, but not in any important features. The exact use made of painted scenery in the Greek theatre is also very uncertain. It is believed, however, that very simple painted backgrounds were hung in front of the *proscenium* in the classical period, possibly being the invention of Sophocles; that each type of drama—tragedy, comedy, and the satyric plays—had its special type of scene; that scenery was, when necessary (which was very rarely the case), changed during a play; and that such objects as the rock of Prometheus were represented by 'properties'. There is mention also of *periaktoi* (almost certainly of post-classical origin), which were tall three-sided prisms painted on each side with a different scene; these stood at either end of the stage, fitting in with the painted background, and could be turned in order to present the side required. In the classical Greek theatre there was almost certainly no drop-curtain. The Greek stage had several mechanical devices: the *ekkyklema*, a small wooden platform, which could be wheeled out upon the stage, bearing a tableau to represent what had just happened behind the scenes; the *mēchanē*, or machine, on which gods descended from heaven ('*deus ex machina*'), or characters were translated from earth; the *theologeion*, by which gods were shown stationary in the sky; and trap-doors for the appearance of ghosts. In tragedy the actors wore masks expressing superhuman dignity or passion, and very thick wooden soles to their shoes (*cothurnus*); their breasts and limbs were padded, and their robes very brilliantly coloured. In comedy also the actors wore masks, exaggeratedly grotesque, and light shoes. In the satyric drama the actors dressed much as in tragedy, though without the *cothurnus*; but Silenus wore shaggy skins.

The Romans in many cases left the *orchestra* when they remodelled the theatres of Greece. In theatres which they newly built, having no use for the *orchestra*, they brought the stage much farther forward, and put a roof over it and seats close up to it. To enable the nearest spectators to see, they lowered the stage to about 5 feet; and, having no need for side entrances into the *orchestra*, they left no space between auditorium and stage on either side. The Roman stage had an architectural background, often very sumptuously built, and in some cases a front curtain, which rose from below the stage.

In England and all Western Europe the stage of the Middle Ages was a growth at first entirely independent of classical influence. In Spain and Italy it long remained no more than a bare movable platform with a curtain hung at the back. In England, and especially in France, it developed more rapidly owing to the religious plays, the cycles of Miracles. In France, by the middle of the sixteenth century, the Miracle stage had become a very large and elaborate though temporary structure, with handsome buildings placed about it: on the (actors') left, Hell, represented by the open mouth of an enormous dragon; on the right, Heaven; and in between them a castle, Jerusalem, the Temple, the Holy Sepulchre, the Lake of Galilee (with real water), and whatever else the play might require, with much machinery for producing spectacular effects. This practice of having all the scenes on the stage at one time persisted in the secular stage of France, and was known as *décor simultané*. In England the original religious stage was, as a general rule, the ground in front of the great door of the church. In the doorway stood the throne of God the Father; there was a raised platform for Heaven on His right hand, and another for Hell on His left; and the intermediate space represented any locality that was needed. From this beginning grew a stage—elaborate indeed, but never so elaborate as the French—temporarily put up in the market-square or some other important part of the town. But the peculiarly English method of staging Miracles was on separate ' pageants ', which could be wheeled in succession from point to point, these pageants having a curtained dressing-room and waiting-room below, and above it a stage which was necessarily small and simple, though costumes and properties were sumptuous.

The origin of the Elizabethan stage is not easily connected with the Miracle stage. Professional performances, in days when acting was much discouraged, were compelled to be much simpler than the great religious cycles, in the production of which the wealthy guilds and private persons of the town had all concurred; and when, in 1576, James Burbage set up the first public playhouse in England, The Theater in Finsbury Fields, his stage was a bare, movable platform, after the fashion of the trestles and planks which the strolling players had set up in the inn-yards. The English stage thereafter developed very rapidly. On certain points in its form and practice opinion is still sharply divided; and not all the Elizabethan stages were exactly alike. But the features that were common to all the public playhouses (see *Theatre*) in the reigns of Elizabeth, James I, and Charles I may be briefly described as follows. The stage was a big wooden platform (the stage of the Fortune Playhouse was 48 feet from side to side), from 4 to 5 feet from the ground, and projecting so far into the ' yard ' that spectators could be set on three sides of it. At least a part of it was roofed over, the roof being supported by pillars. At the back of the stage were hangings of silk, wool, or painted cloth (black when a tragedy was being performed), which could be drawn aside to reveal an inner stage, used for interior scenes or the ' discovery ' of characters. Above this inner stage was a gallery, which could also be curtained off, and was used for upper scenes like Juliet's balcony. These buildings formed the front of the tiring-house, or dressing-rooms and waiting-rooms of the actors, from which there was access to the gallery and to the inner stage, and also to the outer stage, by one or more doors besides the entrance through the inner stage. There was no painted scenery, and therefore no changing of scenes. Properties, such as rocks, trees, and beds, were elaborate and realistic; and the machinery included trap-doors for ghosts, and possibly also a platform, not unlike the *ekkyklema* of the Greeks, on which beds, banquets, and so forth might be wheeled forward from the inner stage. The stage of the ' private ' playhouse (see *Theatre*) differed little from that of the public playhouse, except that it had some artificial light. In performances at court and in noblemen's houses the staging and machinery were much more complicated; and it is practically certain that, besides representations of clouds, mountains, forests, and buildings, scenery painted in perspective was there employed.

The modern English stage owes more to the French and Italian stage of the Renaissance and after than to its own Elizabethan predecessor. From Italy came the first impulse to the modern ' picture-stage '. A return to the Roman design of a shallow stage visible from in front only had led there to the construction of realistic scenery, in which houses and streets were built up solid and practicable in perspective, the great example being the theatre built by Palladio at Vicenza in 1565. The French quickly adopted this idea, and in the time of Molière their stage was already a picture-stage, Molière's comedies for the most part requiring an interior scene with five doors. After the restoration of King Charles II, England did not immediately adopt all the foreign ideas which her exiles had studied in the theatres of France and Italy. The stage remained a platform projecting among the audience and visible from three sides. The ' apron ', as the front part of the stage was called, came so far forward that there was room for two entrances on either side between its front edge and the proscenium (the arch or square where the drop-curtains hung), behind which lay the stage proper. By degrees this apron was shorn away, to the regret of Colley Cibber, manager of Drury Lane, and other upholders of the old rhetorical style of acting. Garrick considerably reduced the apron at Drury Lane; and by the middle of the nineteenth century the picture-stage had entirely replaced the platform-stage, the idea being completely expressed when at the Haymarket Theatre, in 1880, Mr. and Mrs. Bancroft enclosed the proscenium in a four-sided picture-frame. In modern times there is a tendency to return to the platform-stage for the performance of plays written originally for a stage of that kind. At the Savoy Theatre Mr. Granville Barker threw out an apron for his Shakespearean productions; and the Royal Victoria Hall, London, where Shakespeare is regularly performed, has recently added an apron to its stage.

Towards the close of the Commonwealth Sir William D'Avenant probably tried scenery painted in perspective. After the Restoration he made the theatre in Dorset Gardens famous for its scenery and its machines for flying and other effects. Under Garrick at Drury Lane, de Loutherbourg made great advances in the realistic representation of scenes. But nothing has so much helped beauty and spectacular effect in scenery as the improvements in lighting. Footlights, of oil or tallow, were in use in the English theatre at least as early as the seventeenth century. Garrick, after his visit to France in 1765, introduced at Drury Lane concealed lights in place of the chandeliers that had previously hung over the stage from the flies in full view of the audience. Gas was first introduced into London theatres in 1817–8. Electric light, on its introduction at the Savoy in 1881, was at first found less manageable than gas; but recent inventions have enabled it to be raised and lowered as gradually as gas, and to be coloured so as to produce an unlimited variety of tones. New systems of diffusing light have been invented of recent years, some of them with a view to doing away with footlights, the effect of which is considered hard and unnatural. Among these schemes is that known as the Fortuny light, by which absolutely white light is thrown on to bands of coloured silk that act as reflectors, and a ' firmament ' shaped like a half-dome diffuses light over the stage. The Schwabe-Hasait system, recently tried at the St. Martin's Theatre, London, is remarkable for the skies and atmospheric effects which it produces without the need of scenery.

Elaborate scenery has led to many devices for its rapid changing. De Loutherbourg introduced built-up sets at Drury Lane like those upon the Italian stage; but these were difficult to shift, and the theatre in general followed the old principle of a backcloth painted in perspective, and flats or wings of painted canvas on wooden frames pushed on to the stage down the sides. Mr. and Mrs. Bancroft at the Prince of Wales's and the Haymarket Theatre between 1865 and 1882 greatly improved the quality of scenery, and introduced built-up rooms with ceilings and real doors; and at the Lyceum Henry Irving achieved the finest effects possible with the appliances of his time. Since the last two decades of the nineteenth century many advances have been made, chiefly inspired by Austrian inventions, of which the ' Asphaleia ' stage, of Budapest, is the principal. The most modern stages are built of iron, floored with wood, and are divided into sections, each of which can be raised or lowered or turned by hydraulic or electric power; and these powers are also used in scene-shifting, with great saving of time and labour. At the Coliseum in London the stage is a ' turn-table ', that is, a huge revolving circle, on one or more segments of which scenes may be set out of sight, to be wheeled round to the front when needed. Other stages are built in tiers, so that each scene may be raised or lowered to the stage level as it is wanted.

Bibliography: A. E. Haigh, *The Attic Theatre*; K. Mantzius, *A History of Theatrical Art*; E. K. Chambers, *The Mediæval Stage*; A. W. Pollard, *English Miracle Plays*; H. Child, *The Elizabethan Theatre* (in *Cambridge History of English Literature*, vol. vi); W. Archer, *The Elizabethan Stage* (in *Quarterly Review*, No. 415, April, 1908); G. F. Reynolds, *Some Principles of Elizabethan Staging*; W. J. Lawrence, *The Elizabethan Playhouse*; J. Knight, *David Garrick*; P. H. FitzGerald, *History of the English Stage*, and *The World behind the Scenes*; G. C. D. Odell, *Shakespeare from Betterton to Irving*; A. Brereton, *Life of Henry Irving*; M. Bancroft and S. Bancroft, *The Bancrofts*; E. O. Sachs, *Stage Construction*; H. Carter, *The New Spirit in Drama and Art*.

Staggers is the vague and popular name of certain diseases of horses and sheep. In the horse *mad* or *sleepy* staggers is due to inflammation of the brain, while *grass* or *stomach* staggers arises from acute indigestion, generally the result of overfeeding on wet grass. In sheep the staggers is caused by the presence within the brain of the immature embryo of a species of tape-worm (*Tænia Cœnurus*), which, in its mature state, is found in the intestines of the dog.

Stained Glass, a term which properly describes all coloured glass, but which is usually restricted to coloured glass in windows, the colour either being incorporated in the substance of the glass (stained glass proper) or painted on the surface. In the earlier glass, painting was little used, the windows consisting of a mosaic of variously coloured and shaped pieces of glass, held together by grooved strips of lead known as the ' leading ', with wires attached to hold the whole structure to iron bars let into the masonry. A window would consist of one or more 'lights' according to the number of openings in the masonry. With a growing tendency to increase the pictorial and illustrative element in windows, the use of paint to add details, such as features, lines of drapery, and lettering, increased. This pigment was generally an opaque brown substance; and by using it thinly, by hatching in the manner of a pen draughtsman, or by stippling, colour could be modified or modelling indicated. By the sixteenth century it had become a common practice to cover the glass with paint, and to remove this in places to get lights and modelling. An analogous practice in vogue earlier was to use flashed glass (clear glass, with one side covered with coloured glass), the coloured layer being removed where required to obtain white. As early as the fourteenth century also, a solution of silver to modify colour was employed. This stains glass yellow, and by applying it to different coloured glasses a variety of tints could be obtained. In the same period *grisaille* windows appear, made by tracing patterns on clear glass by means of the leading and opaque paint, with sometimes a touch of colour introduced. In the fifteenth and sixteenth centuries the influence of the painter supplanted that of the glazier, and the use of transparent enamel upon glass became common, work being carried out on larger sheets than the small, jewel-like pieces of earlier days. This practice made possible much more elaboration of detail, and a more naturalistic style; but involved a loss of depth and richness in colour, and of breadth and simplicity in handling. This painted glass has also proved less permanent than the old glass, since the enamel is liable to chip and crack, especially when exposed to changes of temperature. To the early stages of this method belong the elaborate heraldic windows painted on clear glass which were common in the fifteenth century.

The history of stained glass is inseparably linked with that of Gothic architecture, of which the chief characteristics are the use of pointed arches, vaulting, and the replacement of a walled structure by what is essentially a scaffolding in stone. The spaces thus left were filled with glass, which gave the stained glass worker his opportunity. The earliest surviving Gothic stained glass dates from the eleventh and twelfth centuries, and in design shows Byzantine influence. In colour, however, it cannot rival the work of the thirteenth century, which is the great age of the art. The designs of this period include the so-called 'medallion' windows, which are divided into compartments corresponding to the iron bars which cross each light. In each medallion incidents from the Bible or the lives of the saints appear, intervals between being filled with scroll work or deeper patterns. Examples are to be seen in the cathedrals of Chartres, Bourges, Lincoln, and Salisbury. In the fourteenth century treatment becomes more naturalistic: single figures of saints appear, generally beneath canopies; the medallion basis of design tends to disappear; and colour becomes less rich. Of this type are some of the windows in York Minster, the cathedrals of Ely and Troyes, and the church of St. Ouen, Rouen. Glass of the fifteenth century is characterized by great brilliancy, owing to the preponderance of white glass. In design the pictures tend to spread beyond one light, and to occupy the whole window. The painter becomes supreme, and tends to disregard the relation of the window to its architectural setting. This is well seen in certain windows at York, Bourges, and Troyes, and in the famous windows in Fairford Church, Gloucestershire. During the Renaissance this pictorial tendency and a change in the character of building helped to kill the art of stained glass, and in the seventeenth and eighteenth centuries examples are mediocre and unimportant. The nineteenth-century Gothic revival helped a revival in glass, though the tendency was merely to imitate old patterns rather than to produce independent work. More original and interesting are the windows carried out by William Morris from designs by Burne-Jones; while the work of John Clayton and John Powell shows great technical skill and understanding of the material.—BIBLIOGRAPHY: F. S. Eden, *Stained Glass*; L. F. Day, *Windows*.

Stainer, Sir John, British composer, was born in 1840, and died in 1901. In 1849 he was appointed organist at Magdalen College, Oxford; in 1872 he became organist at St. Paul's Cathedral, and in 1889 professor of music at Oxford. The most widely known of his numerous compositions are the sacred choral works *The Daughter of Jairus* (1878) and *The Crucifixion* (1887). His best contribution to musical literature is *The Organ*, which appeared as one of Novello's primers, and is a standard work.

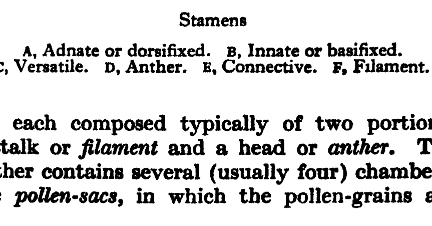
Staines, an old market town of England, in Middlesex, on the Thames, 6 miles from Windsor. Pop. (1921), 7300.

Stairs, a succession of steps raised one above the other, affording means of communication between two points at different heights in a building, &c. Originally the stairs were placed from story to story in straight flights like ladders, and were often external, being sheltered by a projection from the roof, but to save space the spiral form was adopted, the stair being contained in a cylindrical building projecting from the outside of the edifice. In this construction a central axis or *newel* reaching from the ground to the roof serves to support the inner ends of the steps, and the outer ends are let into the walls. The spiral form is still used in certain circumstances; but the finest stairs are now constructed in straight sections separated from each other by a wide step or platform called a *landing*. The separate division, open space, or apartment in which the stair is placed is called the *staircase*.

Stalac′tites, masses of mineral matter, commonly formed of calcium carbonate, and usually in a conical or cylindrical form, pendent from the roofs of caverns, and produced by the filtration of water containing substances in solution through fissures and pores of rocks. Similar masses of small size are frequently to be seen depending from stone arches. The water being evaporated leaves a deposit behind it, which, by the continued trickling of the water, gradually increases in size. Simultaneously with the formation of the stalactite a similar but upward growth, called a stalagmite, takes place at the spot vertically below, where the successive drops of water fall and evaporate. This sometimes forms continuous sheets over the surface, but sometimes rises into columns, which meet and blend with the stalactites above. Small stalactites often retain a central tube through which the excess of water originally ran.

Stalybridge, or **Staleybridge**, a municipal borough of England, in the counties of Lancaster and Chester, on the Tame. Spinning cotton yarns and weaving calicoes are the principal manufactures; but there are also iron-foundries, machine- and millwright-shops, &c. Pop. (1921), 25,200.

Stamens, in botany, those organs in the flower which produce the pollen. They are situated immediately within the petals, and are each composed typically of two portions, a stalk or *filament* and a head or *anther*. The anther contains several (usually four) chambers, the *pollen-sacs*, in which the pollen-grains are produced; when ripe, the pollen-sacs open (dehisce) by slits or pores and liberate the pollen. Stamens are commonly described as male organs, but this usage is not strictly correct, as they are part of the sporophyte, the pollen-sacs being microsporangia and the pollen-grains microspores. The number, form, and arrangement of stamens vary greatly in different flowers. *Andrœcium* is the collective name for all the stamens of a flower.



Stamens

A, Adnate or dorsifixed. B, Innate or basifixed. C, Versatile. D, Anther. E, Connective. F, Filament.

Stamford, a market town and municipal borough of England, partly in Northamptonshire but mainly in Lincolnshire, on the Welland. It is an ancient and irregularly built town, containing interesting churches, of which St. Mary's exhibits some fine specimens of early English architecture, and St. John the Baptist's has a fine wooden roof and screen. In the reign of Henry III Stamford acquired a university with four colleges; this became the head-quarters of the students who seceded from Oxford in 1333. There are manufactures of agricultural implements, and a considerable malting business is carried on. Pop. (1921), 9900.

Stamford, a city of Connecticut, United States, in Fairfield county, on Long Island Sound; served by the New York, New Haven, & Hartford Railway, by steamers to New York City, and by electric railway. Locks and keys (Yale & Towne Manufacturing Company), hardwares, and dye-stuffs are the chief factory products. Many New York business people reside there. Settled in 1641, Stamford became a city in 1894.

Stammering, an affection of the faculty of speech characterized by irregular, imperfect, or spasmodic actions of the muscles concerned in articulation. It manifests itself in a difficulty in beginning the enunciation of words, especially such as begin with an explosive consonant, or in a spasmodic and for a time uncontrollable reiteration of the same syllable after the word is begun; this latter defect being also called *stuttering*. Stammering is always increased by emotional disturbance, and is much mitigated, and often cured, by the patient acquiring confidence in himself, never attempting to speak in a hurry or when the chest is empty of air, or by reading measured sentences slowly and with deliberation.

Stamp Act, an Act for regulating the imposition of stamp duties; especially, an Act passed by the British Parliament in 1765, imposing a duty on all paper, vellum, and parchment used in the American colonies, and declaring all writings on unstamped materials to be null and void.

Stamp Duties, Government duties imposed on legal documents, the amount varying with the nature of the document, and the payment being denoted by an impressed or adhesive stamp. Generally, an unstamped document can be stamped within thirty days (an agreement within only fourteen days) after execution without a penalty; but thereafter a penalty (usually £10) is exigible, but may be remitted in whole or in part. Bills of exchange, bills of lading, marine policies, proxies, and voting papers cannot, as a rule, be stamped after execution; a charter party can be stamped within one month after execution on payment of the duty plus 4*s.* 6*d.* if within seven days, and £10 if after seven days; a receipt within one month on payment of the duty plus £5 if within fourteen days, and £10 if after fourteen days.

Generally (and always, if a document is being stamped after execution), an impressed stamp is required; but an adhesive stamp is permissible in each of the following cases (the values stated being those current in 1922–3): agreements under hand (duty 6*d.*); bills of exchange (including cheques) payable on demand (2*d.*); charter parties (6*d.*); contract notes (6*d.* to 20*s.*); lease of a house for any definite term, not exceeding a year, at a rent not exceeding £10 per annum (1*d.*), or of a furnished house or apartments for any definite period less than a year at a rent exceeding £25 (5*s.*); letters of renunciation (1*d.* or 6*d.*); notarial acts (1*s.*); policies of insurance, not life or marine (1*d.* or 6*d.*); protests of bills or notes (maximum, 1*s.*); proxies liable to 1*d.* duty; receipts (2*d.*); voting papers (1*d.*); and warrants for goods (3*d.*).

An unstamped document cannot be given in evidence in a court of law (except in criminal cases), or be available for any purpose whatever. If it is one which can be stamped after execution, it may be received in evidence on consignation of the amount of the unpaid duty, the penalty, and a further sum of £1.

The duties most commonly met with are the following: bills of exchange and promissory notes (inland); capital duty, on the nominal share capital of limited liability companies; conveyance or transfer, on sale of stocks and shares, lands and buildings; leases; mortgages.

There are certain exemptions from stamp duties, the most important being transfers of Government stocks, and wills.

Standard, Battle of the, a battle in which David I of Scotland, who had espoused the cause of Maud against Stephen, was signally defeated by the English under the Bishop of Durham. It was fought in the neighbourhood of Northallerton, in Yorkshire, on the 22nd of Aug., 1138, and derives its name from the fact that the English levies were gathered round a tall cross mounted on a car, and surrounded by the consecrated banners of St. Cuthbert, St. Wilfred, and St. John of Beverley.

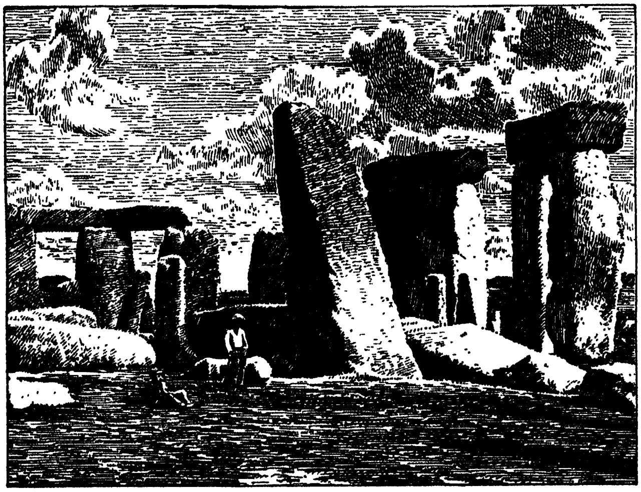
Standardization, in industry and economics, the production of a large number of articles exactly similar to one another in size, shape, and composition. The development of machinery has made it possible to reproduce objects with an accuracy which surpasses that which can be achieved by hand. This is seen very clearly in some branches of the metal industries, in which the system of interchangeable parts has rapidly been perfected. If agricultural machinery, for instance, were made by hand, the first cost would be very high, and any part which was broken could only be replaced by a highly skilled mechanic. As it is, however, the manufacturer keeps a stock of parts exactly similar to those in use, which were made by the same machine and are therefore interchangeable. Thus a farmer in any part of the world is able to use complex machines with confidence, because he knows that if any part gets broken he will be able to secure a duplicate by return of post. The system owes its origin in great measure to Sir Joseph Whitworth's standard gauges; but it has been most highly developed in America, where, for instance, the Ford motor-car is composed entirely of interchangeable parts.

Very great economies in production can undoubtedly be secured by standardization. One of the advantages of trusts in industry is that the adoption of common standards for component parts of fittings, machines, and structures enables the maker of such parts to put through a straight run of ten thousand pieces, when otherwise he might have to break the run a dozen times with a dozen resettings and a dozen sets of specifications, drawings, jigs, and gauges. It is true that such standardization may be achieved by agreement between manufacturers without the sacrifice of independence and competition between them. Thus the British Engineering Standards Association has created and secured the adoption of standards among manufacturers uncombined as well as combined. But there can be no doubt that where a powerful trust or close association exists, standardization is much facilitated.

Standardization also plays an important part in the production of textiles and food products. Here there can be no question of interchangeable parts, but the importance of making one tin of patent food for babies exactly similar in its contents to another, or of making one reel of cotton uniform in quantity and quality with another, will be obvious.

When the term 'standardization' is applied to labour, it means the common rule, enforced by trade unions, that a standard wage shall be paid for standard work throughout an industry. Though it has sometimes been misused, the standardization of labour has been beneficial on the whole to employers and employed alike. To leave the individual workman to sell his labour in the open market to the highest bidder is no longer considered desirable or practicable by enlightened employers, and some standardization is clearly necessary if trades unions are to act effectively as instruments for collective bargaining.

Standing Stones are of wide distribution throughout the world; but there is a well-defined megalithic route from India westwards that is of special significance as showing, apparently, the chronological path of the monuments. These may be divided roughly into three classes: single stones (menhirs), table-stones resting on uprights (dolmens), and complete, or defective, stone circles, with or without avenues. On the continent of Europe, the avenues of Carnac, in Brittany, and, in this country, the circle and its accessories at Stonehenge, in Wiltshire, are the most celebrated of the megaliths. But the remains of Avebury, the neighbour of Stonehenge (q.v.), prove that it was, in this country, the largest circle of which any portion is left. In Scotland, outstanding examples are the cruciform structure at Callernish, in the Island of Lewis, which has unique features, and the Rings of Stennis and Brogar, in the Orkneys. There are hundreds of these standing stones throughout the British Isles, and the original number may have been considerably larger. Single menhirs have been found, which are demonstrably the sole relics of complete circles. Some stones bear cup-marks, sometimes with an encircling ring, or a series of rings. These marks are probably symbols, but their symbolism remains a mystery.


Stonehenge, Wiltshire

Aristotle says that the Iberians had a custom of placing stones round the grave of a warrior, the number of which represented the number of enemies he had slain. That stone circles are frequently grave enclosures is a proved fact. The chambered cairn is usually an accessory of the Stone Age, while the circle is associated mainly with the Bronze Age. Both cultures are, however, sometimes represented in the same structure, pointing to a state of transition. The evidences of this stage are reinforced by the occasional concurrence of inhumation and cremation. In the Stone Age, bodies were usually buried, unburnt; in the Bronze Age, they were generally cremated. In India, megaliths have been set up in modern times for three purposes: (1) as memorials, (2) as grave enclosures, and (3) as temples. These purposes probably exhaust the list of plausible conjectures as to the meaning of the prehistoric megaliths; but a fourth, and a relatively recent speculation, viz. that they were erected as astronomical observatories, has received, of recent years, deserved attention. The late Sir Norman Lockyer advocated this theory powerfully, if, perhaps, inconclusively.

In the past, circles usually bore the popular designation of 'temples', and their authorship was ascribed to the Druids. But it is now known that they existed many centuries earlier than the first historical allusion to the cult of Druidism. On the likely assumption, however, that, as applied to megaliths, the name 'Druids' simply meant a priesthood endowed with powers of magic, it is clear that stone circles have always been associated in popular belief with religion and magic; as, indeed, many local traditions distinctly testify. Probably no single explanation of their origin is altogether satisfying. The original stimulus for their erection may have varied with the environment, and their subsequent use departed occasionally from their initial purpose. In some instances, these different uses may have been successive; in others, contemporaneous. The relation, in prehistoric times, between temples and graves is, for example, suggestively close; while it is a well-established fact that in historic times, stone circles were sometimes used as places of public assembly.

Stanford, Sir Charles Villiers, British composer, born 1852; became organist of Trinity College, Cambridge; professor of composition and orchestral playing at Royal College of Music (1883); professor of music at Cambridge

(1887); conductor of Bach Choir (1885–1902); knighted in 1902. His chief works are: the operas *The Veiled Prophet of Khorassan* (1881), *Savonarola* (1884), *Shamus O'Brien* (1896), and *Much Ado about Nothing* (1901); settings of Tennyson's *Revenge* (1886), Browning's *Cavalier Songs* (1884), Gray's *The Bard* (1895), and Henley's *The Last Post* (1900); the oratorios *The Three Holy Children* (1885) and *Eden* (1891). He also wrote *Musical Composition* (1911) and *A History of Music.* He died in 1924.

Stanhope, the name of a noble English family.—James, first Earl Stanhope, was born 1673, died 1721. He entered the army, served as brigadier-general under the Earl of Peterborough at the capture of Barcelona in 1705, was appointed commander-in-chief of the British forces in Spain, and in 1708 took Port Mahon. He became the favourite minister of George I.—Philip Henry, fifth earl, was born in 1805, and died in 1875. He filled various official positions in the ministry of Sir Robert Peel, but was best known, under his title of Lord Mahon, as the author of a *History of the Succession War in Spain* and various other historical works.—Lady Hester Lucy, daughter of the third Earl Stanhope, was born in 1776, and died in 1839. For some time she kept house for her uncle, William Pitt. In 1810 she left England, visited various places in the East, and finally settled in Syria. She established herself in the deserted convent of Mar Elias in the Lebanon, adopted the style and dress of an Arab chief, and exercised great influence over the Bedouins. Her *Memoirs* were published in 1845–6.

Stanislau, a town of Poland, in Galicia, on the Bistriţa. There are machinery, flour, and leather manufactures. The battle of Stanislau was fought between the Austrians and the Russians in Aug., 1916. The town changed hands several times during the European War. Pop. 33,328.

Stanislaus Augustus (Stanislaus II), the last King of Poland, son of Count Stanislaus Poniatowski, was born in 1732, died in 1798. Sent by Augustus III of Poland on a mission to St. Petersburg (Petrograd), he became a favourite of the grand-princess (afterwards the Empress Catherine), by whose influence he was crowned King of Poland at Warsaw (1764). The nobility, however, objected, and compelled the king to abdicate (1771). He protested against the various partitions of Poland, formally resigned his sovereignty in 1795, and finally died in St. Petersburg as a pensioner of Paul I.

Stanislaus Leszczynski (lesh-chin′ski), (Stanislaus I), King of Poland, was born in 1677, and died in 1766. His father was Grand Treasurer to the Polish Crown, and he himself was Voivode of Posen, when he was recommended to the Warsaw Assembly by Charles XII of Sweden as a candidate for the vacant throne of Poland. He was accordingly elected and crowned (1705), but after the disastrous battle of Poltava (1709), when his patron Charles XII was defeated, he had to flee from Poland. He found refuge in France ultimately, where his daughter Maria became wife to Louis XV. Assisted by the French king, he sought to establish his claim to the throne of Poland in 1733, but, opposed by the united powers of Saxony and Russia, he had again to retire into France, where he held possession of the Duchies of Lorraine and Bar until his death.

Stanley, Arthur Penrhyn, British divine, born 1815, died 1881. He was educated at Rugby and Balliol College, Oxford. He was appointed (1845) preacher to Oxford University, presented to the canonry of Canterbury (1851), travelled extensively in Palestine, accompanied (1862) the Prince of Wales to the East, and (1863) was appointed Dean of Westminster. He was a leader of the Broad Church party, and the author of, among others, the following works: *Life of Arnold* (1844), *Memorials of Canterbury Cathedral* (1855), *Lectures on the Eastern Church* (1861), and *Memorials of Westminster Abbey* (1867).

Stanley, Sir Henry Morton, British African explorer, born near Denbigh 1841, died 1904. He was placed in the poorhouse of St. Asaph at the age of six, shipped (1885) as cabin-boy to New Orleans, and was there adopted by a merchant, whose name he assumed, discarding his own name of John Rowlands. His adoptive father having died intestate, Stanley enlisted in the Confederate army, where he was taken prisoner, but after his discharge he joined the United States navy, and became an ensign on the iron-clad *Ticonderoga.* At the close of the war he went to Turkey as a newspaper correspondent, and as war correspondent for the *New York Herald* he joined the Abyssinian expedition of 1867–8. He afterwards travelled in Spain, and it was while there in 1869 that he was asked by Gordon Bennett, the proprietor of the *New York Herald* ' to go and find Livingstone '. He reached Zanzibar in 1871, and from thence proceeded across Africa in search of Livingstone, whom he met and relieved at Lake Tanganyika in November of the same year, and returned to England, Livingstone having refused to accompany him. He then acted as the *Herald's* correspondent during the Ashanti War (1873–4). As correspondent of the *Daily Telegraph* and the *New York Herald* he in 1874 undertook an expedition into Africa, where he explored the equatorial lake region and for the first time traced the Congo River from the interior to its mouth (1877). For the purpose of developing this vast region, he returned in 1879 under the auspices of the International African Association, founded by the King of the Belgians, and, after planting stations and establishing steam navigation, this territory secured by Stanley was named in 1885 the Congo Free State. In 1887 he organized an expedition for the relief of Emin Pasha, who, after the Mahdist rising in the Sudan, was cooped up with his Egyptian followers in the Equatorial Province of Egypt at Wadelai, north of Lake Albert Nyanza; and, after a series of extraordinary marches, he brought the pasha and his followers to Bagamoyo (Jan., 1890). He was the author of *How I Found Livingstone* (1872); *Through the Dark Continent* (1878); *The Congo, and the Founding of its Free State* (1885); and *In Darkest Africa* (1890). His *Autobiography* appeared in 1909.—BIBLIOGRAPHY: H. W. Little, *Stanley: his Life and Travels*; C. Rowlands, *Henry M. Stanley: the Story of his Life.*

Stannaries, Court of, a court of special and limited jurisdiction for the tin-mines of Devonshire and Cornwall. By an Act of 1896 the stannary jurisdiction was transferred to the county courts, with right of appeal to the Court of Appeal. The courts have jurisdiction in respect of both common law and equity. The common law jurisdiction is wider in Cornwall than in Devonshire.

Stan′ovoi, or **Yablonoi,** a mountain chain in the north-east of Asia, which forms the boundary between Siberia and Manchuria, skirts the Sea of Okhotsk, and is continued to the shores of Behring's Strait. The whole length of the chain has been estimated at 3000 miles. The western part is often distinctively called Yablonoi. This mountain range gives rise to the Rivers Amur and Anadir on its south and east side, and to the Yenisei, Lena, Indighirka, and Kolyma on the north and west side.

Stape′lia, an extensive and curious genus of plants, nat. ord. Asclepiadaceæ, or milk-weeds. Most of the species are natives of the Cape of Good Hope. They are succulent plants, without leaves, frequently covered over with dark tubercles, giving them a very grotesque appearance. In most instances the flowers give off a very unpleasant odour, like that of rotten flesh, insomuch that the name of carrion-flower has been given to some of these plants. They are, nevertheless, cultivated on account of their singular and beautiful flowers.

Staphyli′nus, a genus of beetles with short wing-sheaths, the type of the family Staphylinidæ; commonly called *rove-beetles.*

Staple, according to old usage, a settled mart or market town where certain commodities were chiefly taken for sale. In England, formerly, the king's staple was established in certain ports or towns, and certain goods, such as wools, skins, and leather, could not be exported without being first brought to these ports to be rated and charged with the duty payable to the king or public treasury.

Staraia-Russa, a town of Central Russia, on the Polista. It has a cathedral dating from 1701, and important salt-works. Pop. 20,000.

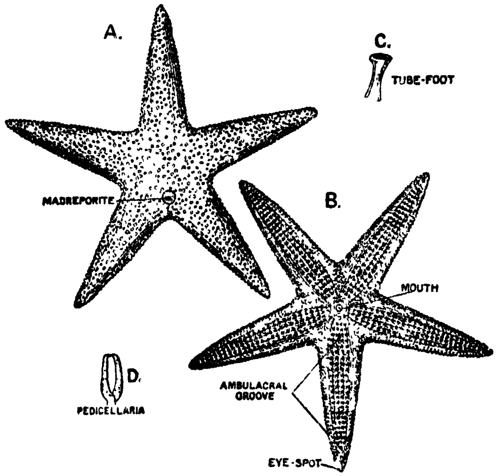
Star-apple, the popular name of several species of plants of the genus Chrysophyllum, nat. ord. Sapotaceæ, whose fruit is esculent. *Chrysophyllum Cainito* is the most important species. It is a native of the West Indies. The fruit resembles a large apple, which in the inside is divided into ten cells, each containing a black seed, surrounded by a gelatinous pulp, which is very palatable.

Starch $(C_6H_{10}O_5)x$, one of the most important chemical products of the vegetable kingdom, found in practically all plant tissues, more especially in seeds and tubers. As examples of seeds we have wheat, rice, and other cereals; of tubers, the potato; of the stem, the sago plant. The starch of commerce is chiefly extracted from wheat-flour and potatoes. When pure, it is a snow-white powder of a glistening appearance. It is composed of transparent rounded grains, the size of which varies in different plants, those of the potato being among the largest, and those of wheat and rice the smallest. Each granule consists of a series of stratified concentric layers around a hilum, which usually occupies an eccentric position. It is insoluble in cold water, alcohol, and ether; but when heated with water the grains become ruptured, forming an opalescent colloidal solution. As the mass cools, it forms a stiff semi-opaque jelly. If dried up, this yields a translucent mass, which softens and swells into a jelly with water. It is employed for stiffening linen and other cloth. When heated at a moderate temperature in an oven, it is converted into a species of gum employed by calico-printers; potato starch answers best for this purpose. (See *Dextrine.*) Starch is converted into glucose when boiled with dilute sulphuric acid; it forms the greatest portion of all farinaceous substances, particularly wheat-flour, and it is the chief ingredient of bread. Starch gives a characteristic deep-blue colour with a drop of iodine solution.

Star Chamber (*Camera Stellata*), a room in the old House of Lords, so called from its ceiling being adorned with gilt stars, or, according to some, because it was originally the place of deposit of the Jewish *sh'tar* or covenants. The term is also applied to the despotic tribunal which sat there. This court of civil and criminal jurisdiction consisted originally of a committee of the Privy Council, and was remodelled during the reign of Henry VII, when it consisted of four high officers of State, with power to add to their number a bishop and a temporal Lord of the Council, and two justices of the courts of Westminster. It had jurisdiction of forgery, perjury, riots, maintenance, fraud, libel, and conspiracy, and could inflict any punishment short of death. Its process was summary and often iniquitous (especially in the reigns of James I and Charles I), and the punishment it inflicted often arbitrary and cruel. This court was abolished (1640) by statute 16 Charles I.—Bibliography: Sir T. Smith, *Commonwealth of England*; A. V. Dicey, *The Privy Council*; C. L. Scofield, *A Study of the Court of Star Chamber*.

Starch-hyacinth, a plant, the *Muscāri racemōsum*, of the same natural order as the hyacinth, and named from the smell of the flower. Called also *Musk-hyacinth* and *Grape-hyacinth*.

Star-fishes, a term in its widest application embracing all the echinoderms comprised in the orders Ophiuroidea and Asteroidea, but more commonly restricted to the members of the latter order, of which the common genus Asterias may be taken as the type. The star-fishes proper are covered with a tough leathery skin beset with prickles, and have the form of a star, with five or more rays radiating from a central disc. In the middle of the under surface of the disc is situated the mouth, opening into a digestive system which sends prolongations into each ray. If the prickly skin be removed, it will be seen to be supported by a series of plates beautifully jointed together. On the under surface of each ray the plates exhibit a series of perforations, through which, in the living state, the tube-feet can be protruded so as to effect locomotion. Star-fishes inhabit almost all tropical and European seas, and some species are found as far north as Greenland.



Common Star-fish (*Uraster rubens*)

A and B, Upper and under surfaces, reduced. C and D are enlarged.

Stargard, a town of Germany, in the province of Pomerania, Prussia, on the Ihna. It has manufactures of leather, machinery, hats, soap, spirits, &c. Stargard, which became a town in 1229, was a member of the Hanseatic League. Pop. 27,500. Stargard is an important railway junction for Posen, on the Stettin-Belgard line.

Another Stargard (*Stargard-an-der-Linde*) is in Mecklenburg-Strelitz, on the Berlin-Stralsund line of the State Railways. It has several sawmills, a fulling-mill, and cloth- and woollen-manufacturing industries. Pop. (about) 7000.

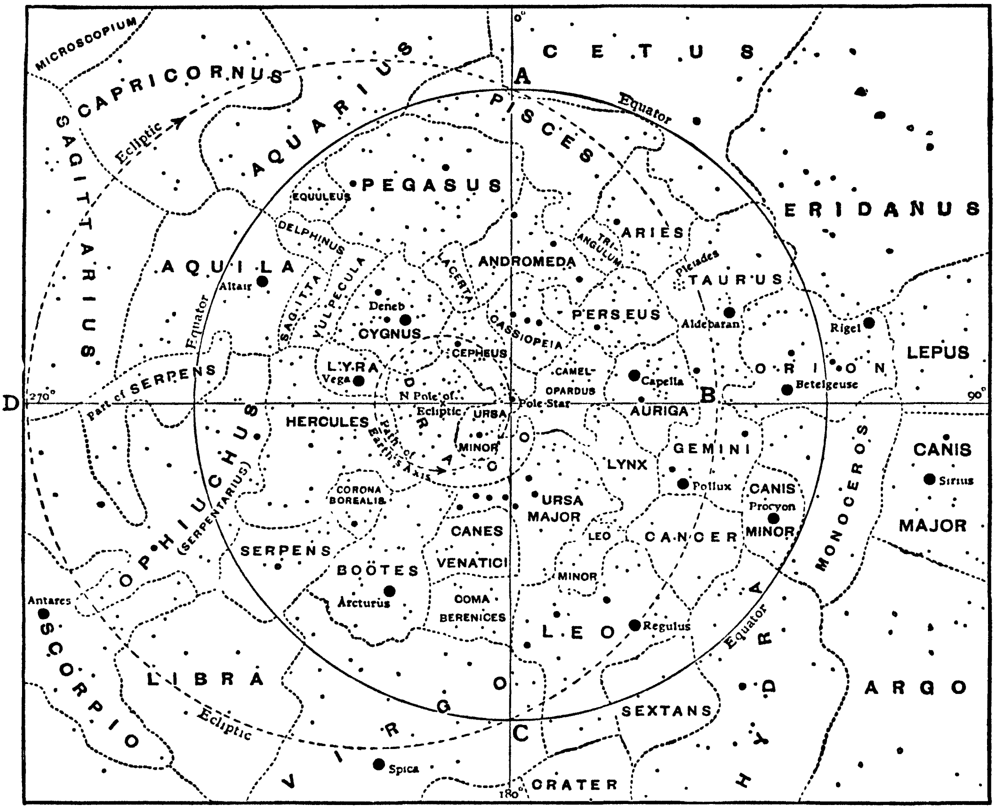
Star-gazer, spiny finned fishes of the genus Uranoscopus, one of which (*U. scaber*) inhabits the Mediterranean, and so called because the eyes are situated on the top of the head and directed towards the heavens. The name is also applied to fishes belonging to the family Cyprinodontidæ, of which *Anableps tetrophthalmus* is the best-known type. It is found in the rivers of Guiana, and acquires its name of 'four eyes' from its prominent and apparently divided eyes. See *Anableps*.

Starling, a perching bird of the genus Sturnus and family Sturnidæ, a family of birds widely distributed throughout the world, and allied to the crows. The common starling (*Sturnus vulgāris*) is found in almost all parts of Europe. It is between 8 and 9 inches in length; the colour is blackish, with blue, purplish, or cupreous reflections, and each feather is marked at the extremity with a whitish triangular speck, giving the bird a speckled appearance. Starlings live upon insects and fruit, build in old walls and hollow trees, and the eggs, usually five, are of a pale-bluish tint. These birds are often kept in cages, and may be taught to whistle some tunes, and even to pronounce words and sentences. Allied species are the *S. unicolor*, found in Sardinia, and the rose-coloured pastor of Asia and Africa (*Pastor roseus*).

Star of Bethlehem (*Ornithogălum umbellātum*, nat. ord. Liliaceæ), a bulbous-rooted plant with white star-like flowers. It is common in many parts of Europe, and is much cultivated in gardens for ornament.

Star-reed, a Peruvian plant of the genus Aristolochia, the *A. fragrantissima*, the root of which is highly esteemed in Peru as a remedy against dysenteries, malignant inflammatory fevers, colds, rheumatic pains, &c.

Stars, large material bodies situated in space. Their existence is made known to us by their radiation of light, but we have also reason to believe that there are dark or extinct stars which have become too cold to be incandescent. Owing to their immense distances, the motions of the stars are not to be detected by rough observations within moderate intervals of time, and they have been called *fixed stars*, to distinguish them from the wandering stars, or planets. Each star, however, has its individual 'proper motion'. The sun is itself a star, and others of the stars may have systems of planets, though it is doubtful whether such systems are common, or even other than exceptional. Some six thousand stars are visible to naked-eye view in the whole celestial sphere, but of these only about one-half can be above any local horizon simultaneously. The telescope and celestial photography increase the number to hundreds of millions. The telescope shows that the light of the Milky Way is due to immense numbers of stars, too faint and numerous to be separately discerned without optical aid. The Milky Way forms practically a great circle on the heavens, surrounding us in one plane. This plane appears to be fundamental in the structure of the universe. The number of stars per square degree falls off gradually with increasing distance from it. Sir W. Herschel held that the sidereal universe was of grindstone form, the sun being near its centre. This view fell into disfavour, but recent investigations have furnished some evidence in its support, Another conception is that the Milky Way is a sort of ring of star clouds of varying density, surrounding us at a vast distance. Within this, stars are strewn more sparsely, and arranged in a somewhat ellipsoidal or bun-shaped form, our solar system being near the centre of this ellipsoid, whose circumference may or may not be as remote as the inner side of the Milky Way. Another view regards the Milky Way as forming a vast spiral nebula of star streams, the spiral arms at least two in number. The spectroscope has greatly added to our knowledge of the stars, by enabling us to determine their speed and direction of motion in the line of sight, and the elements existing in their atmospheres. According to



Constellations and Chief Stars of the Northern Hemisphere, with those of the Southern Hemisphere which are adjacent to the Equator their spectra, they have been arranged in classes. It is believed that in an early stage a star is of great size but of very low density, being entirely gaseous, and comparatively cool. As it contracts from this state it becomes hotter, and the increasing temperature makes up for the diminution of surface, so that it continues to shine brightly. Later, its further contraction is accompanied by cooling, and its luminosity falls off. Finally, perhaps, it becomes non-luminous and solid. In the early giant stage and in the latest declining stage it shines with a red light. When hotter it is yellow, and if when hottest it reaches a sufficient temperature, its colour is white or bluish. The sun is supposed to be in the declining yellow stage at a temperature of some 6000° C., whereas a white star may be at 15,000° C. or more. In numerous instances stars are strikingly arranged in clusters, having doubtless some physical association of origin or development. In other cases, stars which have no obvious affinity are found to be moving in parallel paths through space with a common velocity, like a flock of birds. These must also have some physical relationship. With reference to the average of the stars, the sun is travelling at about 12 miles per second towards a point in the constellation Hercules. It has recently been found that the motions of the stars as a whole are not purely at random, but that there is a marked preference for motions parallel to two particular directions. Thus the stars may be said to be arranged in two great streams or drifts, the component members of each having their own additional individual motions. Various explanations have been suggested, such as that the system consists of two originally distinct, but now interpenetrating, universes, or that the entire system is ellipsoidal, with predominance of motions parallel to the greatest axis.

The nearest (so far as we know) of the stars is distant about 25 millions of millions of miles, and its light takes 4¼ years to reach us. The diameter of the Milky Way must at least extend to thousands of light-years. A high proportion of the stars are *double* or *multiple*, consisting of a group of two or more stars revolving under their mutual gravitational attractions. There are many *variable* stars, whose light fluctuates in a long or short, regular or irregular period. The *new* or *temporary* stars which blaze out from time to time, and which are little understood, are clearly a class of objects widely different in nature from ordinary lucid stars. From their immense distances the angular diameters of stars are imperceptible, but in 1920 for the first time measurements of angular diameter were made indirectly by a method depending on the interference of light. The first stars so measured were red stars of the giant type, and some appear to have diameters of the order of 250,000,000 miles. See *Astronomy*, *Nebulæ*; *Meteor*.—BIBLIOGRAPHY: J. F. W. Herschel, *Outlines of Astronomy*; Agnes Clerke, *System of the Stars*; S. Newcomb, *The Stars: a Study of the Universe*; W. W. Campbell, *Stellar Motions*; A. S. Eddington, *Stellar Movements and the Structure of the Universe*; Observational: T. W. Webb, *Celestial Objects* (vol. ii); Elementary: R. A. Proctor, *Half-hours with the Stars*; J. Gall, *Easy Guide to the Constellations*.

Starter, a culture of definite bacteria used as a control in the making of butter, cheese, and fermented milk. The commercial culture starter is more pure and reliable than one which is derived from naturally soured milk, whey, or buttermilk. In cheese-making the quality of the starter entirely controls the flavour of the finished cheese, and in butter-making the use of starter and pasteurized cream has ensured Danish supremacy in British markets, on account of the uniformity of their product, its flavour, and excellent keeping quality, all of which are due partly to the starter employed.

Star-thistle, a British plant (*Centaurea Calcitrapa*) which grows in gravelly, sandy, and waste places in the middle and south of England, especially near the sea, and is remarkable for its long spreading spiny bracts. The *yellow star-thistle* (*Centaurea solstitialis*) is occasionally seen in fields and waste places, principally in the east and south of England, and near Dublin. It is also called *St. Barnaby's thistle*. The *Jersey star-thistle* (*Centaurea Isnardi*) grows in pastures in Jersey and Guernsey.

Starvation, or **Inanition,** is the physical effect produced by complete withdrawal of food and water. There is an increasing loss of weight and loss of strength, and a strong disinclination to undertake any mental or physical exertion. This passes later into sleep or semi-stupor, which can only be avoided by an effort of will. There is great thirst when no water is taken. A person completely deprived of food does not suffer pain, but for the first few days there is a craving for food. During starvation the body has to get its energy for the maintenance of the body temperature and for the movements of respiration and circulation from its own tissues, and it has been found that most of this energy is supplied by a loss of fat in the tissues, and that organs like the brain, heart, and respiratory muscles undergo very little loss of weight. Death takes place when the body has lost about 50 per cent of its original weight. If water is given, life may continue for about one month, but exceptional cases are recorded of six to seven weeks' duration.

Starwort, the popular name of several plants, some of them belonging to the genus Stellaria, or that of chickweed. *Sea starwort* is a British herbaceous plant of the genus Aster, the *A. Tripolium*. It has pale-blue flowers with a yellow disc, and grows in salt marshes.

Stassfurt, a town of Prussia, in the province of Saxony, district of Magdeburg, on the Bode. Pop. 17,000.

Stassfurt Deposits. The district around the Prussian town of Stassfurt, south of Magdeburg and east of the Harz Mountains, was long known for its deposits of rock-salt, occurring in Triassic and Permian strata. Several borings in 1855 revealed the presence of certain beds containing soluble salts of magnesium and potassium (see *Potash Salts*), and the agricultural value of the potassium chloride contained in some of these was pointed out in 1865. *Kainite* and *carnallite*, with *sylvinite*, a mixture of sodium and potassium chlorides, have since that date become materials of immense commercial importance. The price of the various products sold is now carefully based on the potassium content, calculated for trade purposes as potash. The salts were accumulated in a desiccating lagoon or lake of Permian age, and interactions have gone on between them in the course of their long history underground. The chemistry of the salts has formed the subject of a series of memoirs by van't Hoff and his pupils at Berlin. The deposits have been much folded in places, and some of the disturbances have been attributed to large changes of bulk in the saline layers, as water was chemically absorbed or given off during temperature-changes in the past. A good account of the geological relations of the beds has been given by Everding in the *Abhandlungen der kön. preuss. geol. Landesanstalt*, 1907.

State. The State is the body politic, or that entity of society which exercises a sovereign political will. Sir Erskine Holland (*Elements of Jurisprudence*) defines the State as " a numerous assemblage of human beings, occupying a certain territory, amongst whom the will of the majority or of an ascertainable class of persons is, by the strength of such a majority or class, made to prevail against any of their number who oppose it ". The State presupposes first of all a psychological element, i.e. a desire existing in the minds of the people to form a collectivity or a body politic. The realization of this consciousness of unity in common laws and a common government engenders the State. The term *society* is wider than State. It applies to an assembly of individuals who live together united by social interests, whether organized or unorganized. A *nation*, again, is a term denoting a collection of individuals united by ethnic and linguistic bonds.

The chief theories proposed as to the origin of the State are those of divine right, social contract, and force. The theory of divine right, or of the divine right of kings, explained the State as a direct divine creation. The chief exponents of the contract theory were Hobbes and Locke in England, and Jean Jacques Rousseau in France. The theory of force explained the State as the result of usurpation, and government as the outcome of human aggression and the enslavement of the weaker by the stronger. The modern or evolutionary theory, however, rejects the above theories, and considers the State as the ' product of history ', or a ' gradual development of human society ' from rudimentary beginnings, wherein the conscious will of the individual has played a very subordinate part. See *Politics*. — BIBLIOGRAPHY: B. Bosanquet, *The Philosophical Theory of the State*; W. W. Willoughby, *Examination of the Nature of the State*; Stephen Leacock, *Elements of Political Science*.

Staten Island, an island of the United States, constituting the borough of Richmond in the City of New York, and separated from Long Island by the Narrows, which form the entrance to New York harbour, and from New Jersey by Staten Island Sound, about ¼ mile broad. Its length is 14 miles, and its greatest breadth 8 miles. It contains numerous villages, abounds in pleasant scenery, and has constant communication with New York by steam ferry-boats. Pop. 100,000.

Staten Island, a mountainous island off the south-east coast of Tierra-del-Fuego, separated from the mainland by the Strait of Le Maire. The chief harbour is Port Parry.

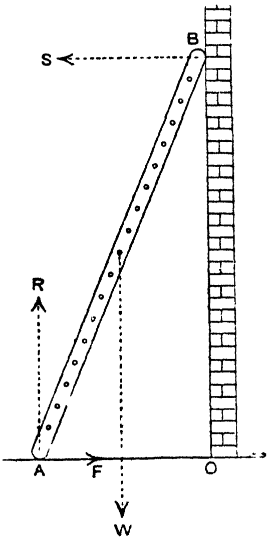
States-General (Fr. *États Généraux*), the name given in France till 1789 to a body representing the three orders of the nation, the clergy, nobility, and the commons or third estate (*tiers état*). The right of convoking the States belonged to the king, to the regent, or the lieutenant-general of the kingdom. Each Deputy sent to the States-General carried with him a *cahier*, or statement of grievances, and general *cahiers* of the different orders were presented to the king, who usually promised to redress the grievances complained of. The States had no legislative power, but it was a principle that without their consent no taxation could be imposed. The States-General rarely met. Convoked for the first time in 1302 by Philip the Fair, who wished to obtain their aid in his struggle against Pope Boniface VIII, they met for the last time before the Revolution in 1614. In 1789, under Louis XVI, the three orders met once more, but the *tiers état* eventually assumed to itself the title of National Assembly, and that of States-General was never afterwards revived in France. The name of States-General (Du. *De Staten Generaal*) is also given to the legislative assembly of the Kingdom of the Netherlands.

Statice (stat′i-sē), a genus of herbaceous or sub-shrubby plants, nat. ord. Plumbaginaceæ. A number are cultivated in Britain, among them being *S. latifolia*, a Siberian species with blue flowers. The principal British species is *S. Limonium*, usually known as the sea-lavender. It is fairly common on the coasts of the United Kingdom.

Statics is that branch of the science of dynamics (q.v.) which treats of equilibrium, or the balancing of forces, and of the equivalence of systems of forces. Historically, statics was the first branch of dynamics to be developed, its fundamental principles being well understood by Archimedes, and applied by him both to solids and fluids. Pure statics takes no account of any property of matter except its ability to transmit force, and the whole science can be deduced from a few definitions and postulates which may be stated as follows: (1) A force has magnitude, line of action, sense (forward or backward), and point of application, so that it can be fully represented by a directed line-segment or localized vector, with a point of application. (2) Two equal and opposite forces, i.e. forces which have the same line of action and opposite sense, if acting on the same rigid body (or body which retains its size and shape under the action of the forces) are in equilibrium, whether the points of application coincide or not. (3) If two systems of forces are separately in equilibrium, they will form a single system in equilibrium if they act on the same body at the same time. Conversely, if a set of forces in equilibrium includes a group of forces which is itself in equilibrium, then the remaining forces will be in equilibrium if that group is removed (*principle of superposition of forces in equilibrium*). (4) If a set of forces is equivalent to a single force, that force is called their *resultant*. (5) (*Parallelogram of forces.*) If OA and OB represent two forces acting at O, and if the parallelogram AOBC be completed, the diagonal OC will represent the resultant.

The simplest case occurs when the forces of the system have a common point of application. In this case the resultant is the vector-sum of the components, i.e. if OA, AB, BC . . . KL represent the components in magnitude and direction, OL represents their resultant. It follows that if L coincides with O, the forces will be in equilibrium. This proposition is known as the *polygon of forces*. If a force F is the resultant of two forces, one parallel and the other perpendicular to a straight line OX, the former is called the *resolute*, or *component*, of F in the direction OX. It is F cosα, where α is the angle between OX and the direction of F. The *moment* of a force F about a point O is the product Fp, where p is the length of the perpendicular from O on the line of action of F. It measures the effect of the force in producing rotation of a body pivoted at O, and is positive or negative according as it tends to produce positive or negative rotation. If AB represents the force, the measure of the moment about O is the same as twice the measure of the area OAB. A *couple* consists of two forces which are equal, opposite in direction, but not in the same line. Its *moment* is the algebraic sum of the moments of its forces about any point in its plane, and is = Fp, F being one of the forces, and p the distance between their lines of action.

Coplanar Forces.—The chief theorems regarding these are: (1) Any set of coplanar forces is equivalent to a single force, a couple, or zero. (2) For any two equivalent systems Σ (moments about any point) is the same for both. Here, and in what follows, the symbol Σ is used to denote 'the algebraic sum of'. Cor. If a system is in equilibrium, Σ (moments about any point) = 0. (3) For any two equivalent systems Σ (resolutes in any direction) is the same for both. Hence for a system in equilibrium, Σ (resolutes) = 0. From (1), (2), (3) we can deduce necessar and sufficient conditions for equilibrium fo coplanar forces; these may be stated as follows Σ (resolutes in some direction) = 0, Σ (resolute in another direction) = 0, Σ (moments abou a point) = 0. These three conditions may b replaced by three others, e.g. Σ (moments) = 0 taken about any three non-collinear points.



As a simple example of the application of thes conditions, take the case of a uniform ladder o weight W resting on a rough floor AO, with th upper end B resting on a smooth vertical wal OB; and let it be required to determine th normal reactions R and S, and the friction F Resolving in direction OA, S − F = 0; re solving in direction OB, R − W = 0; takin moments about A, S.OB − W.$\frac{OA}{2}$ = 0; whenc $\frac{S}{W} = \frac{1}{2}\frac{OA}{OB} = \frac{1}{2}$ cotOAB. Hence, if the angl OAB is known. S, F, and R are determined.

(4) In general, a set of parallel forces (even i

not coplanar) is equivalent to a single force parallel to them, equal to their algebraic sum. Its line of action is determined by (2). The exceptional case is when the system is equivalent to a *couple*, or pair of equal but oppositely directed parallel forces. (5) If the points of application of a system of parallel forces are fixed, and also their magnitudes, while their common direction changes, the line of action of their resultant will change, but it will continue to pass through a certain point called the *centre* of the system of parallel forces. This theorem forms the basis of the theory of *centres of gravity*, or *centres of mass*, the centre of mass of a system of particles being the centre of parallel forces for a set of forces proportional to the masses of the particles, and acting on them. (6) The co-ordinates $\bar{x}$, $\bar{y}$, $\bar{z}$ of the centre of mass of a system of particles of masses m_1, m_2, m_3, . . . at points (x_1, y_1, z_1), (x_2, y_2, z_2) . . . are determined by the equations $\bar{x}\Sigma m = \Sigma mx$, $\bar{y}\Sigma m = \Sigma my$, $\bar{z}\Sigma m = \Sigma mz$.

Forces in three dimensions, i.e. non-coplanar systems.—Here a further definition is required, that of the *moment of a force about an axis*. It may be geometrically defined as measured by six times the volume of the tetrahedron OUAB, where AB represents the force, and OU is a unit length of the axis. It follows that what was defined as the moment of a force AB about a point O is the same as the moment about an axis through O normal to the plane OAB. The *axis of a couple* is defined as a vector perpendicular to its plane, representing by its length the magnitude of the couple's moment. The chief theorems for non-coplanar forces may be thus stated: (7) Any such system is equivalent to a force at an arbitrarily chosen point, together with a couple. (8) The point may be so chosen that the *axis* of the couple has the same direction as the force, whose line of action is then the *central axis of the system.* (9) Taking an arbitrary origin for rectangular co-ordinates, any force-system is equivalent to three forces X, Y, Z, acting along the axes, together with three couples L, M, N, whose axes are along the co-ordinate axes; where $X = \Sigma$ (resolutes of forces, in direction of x-axis), $L = \Sigma$ (moments of forces, about the x-axis), and similarly for the others. Hence the six conditions for equilibrium are: X, Y, Z, L, M, N, each $= 0$. (10) *Theory of couples.* Non-coplanar couples are compounded by the vector-addition of their *axes*, so that the resultant of the couples whose axes are OA, AB, BC, . . ., KL is the couple whose axis is OL. (11) Any force-system is equivalent to a unique set of forces acting along the edges of a chosen tetrahedron. Hence we have an alternative set of conditions for equilibrium, viz. Σ (moments of given forces) $= 0$, *taken about each of the six edges of an tetrahedron.*

Stability of Equilibrium.—If a body or system of bodies is slightly displaced from a position of equilibrium, it may tend to move farther away from, or return towards, the equilibrium position, or it may remain in equilibrium. The original state of equilibrium is said to be unstable, stable, or neutral in these three cases. An example of stable equilibrium is a sphere resting at the bottom of a spherical bowl; of unstable, a smooth sphere resting on the top of a fixed smooth sphere; of neutral, a sphere resting on a horizontal plane. Equilibrium may be stable for one type of displacement and unstable for another, as when a sphere rests on a saddle-shaped surface. When a body is supported, under gravity, at a fixed point, the equilibrium will be stable or unstable according as that point is above or below the centre of gravity. If, however, one surface of the body rests on a fixed surface in equilibrium, the stability will depend on the relative positions of the centre of gravity and of a point which is the intersection of the normals at the original and new points of contact of the surface of the body. Equilibrium is stable or unstable according as the potential energy of the system is a minimum or a maximum. The general theory is best treated by methods connected with the Principle of *Virtual Work* (q.v.). This principle, first developed by Laplace, who named it Principle of Virtual Velocities, is specially useful in dealing with the statics of connected systems of bodies.

Other branches of statics, fully discussed in the textbooks, are: *attractions*, including gravitational statics and electrostatics; *statics of strings*; and *graphic statics* (see *Statics, Graphic*). —BIBLIOGRAPHY: E. J. Routh, *Treatise on Analytical Statics*; S. L. Loney, *An Elementary Treatise on Statics*; more elementary works by W. J. Dobbs, R. C. Fawdry, Briggs and Bryan.

Statics, Graphic. In its wider signification, graphic statics includes all those methods by which problems in statics are worked out by diagrams drawn to scale. In its more restricted sense, it applies to the method based on two related diagrams, the *Polygon of Forces* (see *Statics*) and the *Funicular Polygon* of Varignon, a method developed by Culmann (*Graphische Statik*, Zurich, 1866) and later writers. The principle of the method may be indicated by a simple example. ABCDA is a force-polygon, representing in magnitude and direction the four equilibrating forces 1, 2, 3, 4. The lines of action of these forces are those marked 1°, 2°, 3°, 4° in fig. 2, which are such that the 'funicular polygon' P, Q, R, S has its sides parallel to OA, OB, OC, OD in fig. 1, where O is an arbitrarily chosen *pole*. By the 'triangle of forces' it will be seen that the forces 1, 5, 8, represented by the sides of the triangle ABO in fig. 1, will be in equilibrium if they act along the lines 1°, 5°, 8° in fig. 2, and similarly for the sets of forces acting at Q, at R, and at S. Thus if PQRS is a material frame of bars freely jointed together at the corners, it will be in equilibrium under forces 1, 2, 3, 4 acting along the lines 1°, 2°, 3°, 4°. The stresses in the bars PQ, QR, RS, SP are represented by the lines 5, 6, 7, 8 in fig. 1. Fig. 1 and fig. 2 are reciprocally related; to each line in one there is a corresponding parallel line in the other, and to each point of concurrence of lines in one corresponds a polygon or triangle in the other. On this property is based R. H. Bow's notation, where the same letters OABCD denote *points* in fig. 1 and corresponding *spaces* in fig. 2. The line 8° separating the spaces O, A in fig. 2 corresponds to the line 8 joining the points O, A in fig. 1.

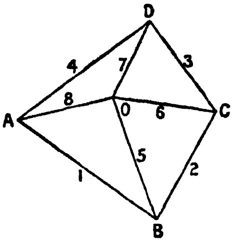


Fig. 1

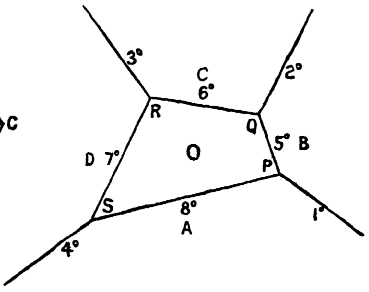


Fig. 2

These related diagrams may be applied to find the resultant of any coplanar set of forces acting on a body. Thus if the magnitudes of three forces are given by AB, BC, CD, and their lines of action are 1°, 2°, 3°, we can take any point O as pole and complete fig. 1. Taking then an arbitrarily chosen point P on 1°, we draw PQ, QR parallel to OB, OC, then lines through P and R parallel to OA and OD. The intersection S of these two is a point on the line of action of the equilibrant of the three given forces; and their resultant has of course the same magnitude and line of action. Thus AD gives the resultant in magnitude and direction, and a line 4° through S parallel to AD is its line of action.

It is obvious that the method can be applied to find the centre of gravity of a system of heavy particles.

Graphic statics in its more general sense includes constructions for shear and bending moment of loaded beams, for first and second moments of plane areas, for stresses on retaining walls, and for many other magnitudes occurring in the theory of structures.—BIBLIOGRAPHY: R. H. Graham, *Graphic and Analytic Statics*; L. M. Hoskins, *Elements of Graphic Statics*; M. Lévy, *La Statique graphique*; A. Föppl, *Technische Mechanik* (vol. i).

Stationery Office, British Government office in London, founded in 1782, and supplying writing materials to the Government offices at home and abroad. It also publishes most official publications, which are printed in its works at Harrow (founded 1921). In its head (the controller) the copyright of all its publications is vested.

Station-pointer, or **Station-plotter,** an instrument used in navigation and surveying to fix an observer's position. It consists of three straight legs, pivoted at a common centre, so that they can be opened out to make any assigned angles with each other. An observer at a point O observes the angles AOB, BOC subtended at O by the lines AB and BC, where A, B, C are known points marked on the chart or map. The station-pointer is adjusted so that the angles formed by its legs are equal to AOB and BOC, and the instrument is moved about on the chart until the legs pass through A, B, C respectively. The centre of the pointer is then at the observer's position.

Stations, a name variously used in the Roman Catholic Church, but especially applied to the places at which ecclesiastical processions pause for the performance of an act of devotion, and to those representations of the successive stages of our Lord's passion which are often placed round the naves of large churches, and by the side of the way leading to sacred edifices, and which are visited in rotation.

Stations, Railway. The layout of the permanent way, buildings, and other structures and works necessary at railway stations, whether used for passenger or goods traffic, is naturally governed to a great extent by such factors as the arrangement and number of lines which pass,

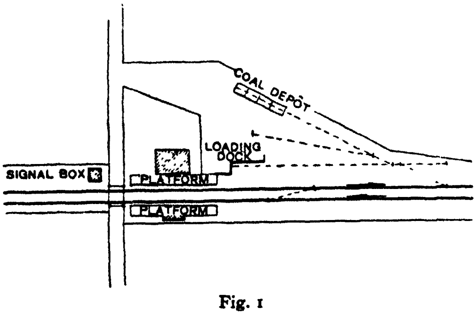


Fig. 1

or are to pass, through the station, and the nature and density of both through and local traffic. Where the station is terminal for either passenger or goods traffic, the conditions are somewhat different, the layout being determined by the population of the area served by the passenger station, or the volume and character of the traffic carried by the railway in connection with local industries. Also, in all cases the area of ground available for the construction of the station must naturally influence the layout. Fig. 1 (p. 357) shows a typical layout of an ordinary small through passenger station on a double line railway, with the necessary sidings and accommodation for dealing with light local traffic. Where there are four through lines, the layout will depend upon the arrangement of these lines. Fig. 2 shows a suitable layout in a case where the two middle lines are used for fast traffic and the two outside lines for local passenger or goods traffic.

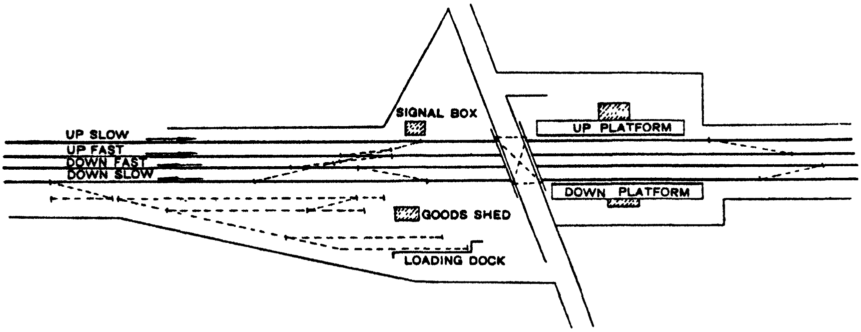


Fig. 2

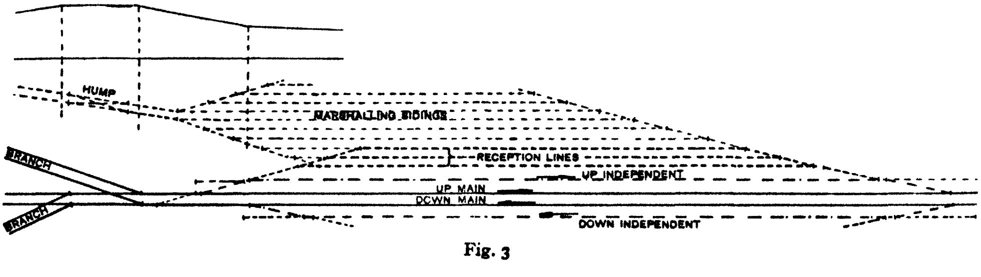


Fig. 3

Through goods and mineral traffic may be dealt with in the yards usually connected with the larger stations, or it may be sent to a separate marshalling yard, where it is split up, sorted, and made up into fresh trains for conveyance to destination. The layout of these marshalling yards consists essentially of sidings or reception lines into which the trains pass when arriving at the yard. They are then drawn out and sorted, the wagons passing on to one or other of the marshalling sidings according to final destination. This operation of sorting is facilitated by the use of 'hump' shunting, the track being raised at a point near the entrance to the marshalling sidings in order to form a steep gradient falling in the direction of the sidings. The train to be sorted is drawn over the hump on to the shunting line, and then slowly propelled in the direction of the marshalling sidings, the wagons on reaching the summit being uncoupled and allowed to gravitate into one or other of the sidings. A typical layout for hump shunting in a large marshalling yard is shown in fig. 3.

Under the requirements of the Board of Trade in regard to the opening of railways, certain rules are laid down, and when designing new stations adherence to these rules is necessary. The maximum distance at which switches in a facing direction, and connected to a signal-box, can be placed from the lever working them is 250 yards, unless they are power-worked, when this distance is provisionally extended to 300 yards. Switches in a trailing direction, and connected to a signal-box, must not be more than 300 yards from the lever working them.

Statistics has been defined as the science of dealing with large numbers. Statistical methods can be applied to all sciences that involve large numbers of measurements, in particular to chemistry, physics, astronomy, and meteorology. From many determinations of a given quantity, statistics enables us to estimate its most probable value and the probable error in the estimation. In biology, the variations of a measured quantity from the mean offer valuable information; thus statistics may be applied to the theory of evolution. But it is the application of statistics to the two sciences of demography and economics that is popularly called 'statistics'. The term is thence transferred to the collections of data themselves. We must thus distinguish (1) the sources of data, and (2) methods of treating the data (statistics proper).

(1) *Sources of Statistical Data.*—For most of our statistics we are dependent on official returns published by Governments. These, being produced primarily for administrative purposes, do not always give the facts required by the scientist. For instance, we are better informed about our foreign trade than about our much more extensive inland trade.

In *demography*, that is, the description of the population as a whole with respect to numbers, age, sex, and rates of birth, marriage, and death, we have the Registrar-General's *Annual Report* and *Decennial Census*, and the *Annual Report* of the National Insurance Commissioners.

In *economics*, information is available from official and from non-official sources. The census classifies the population according to occupation. Government Departments publish statistics of imports and exports, of mines, of railways, and of a few other inland industries, of industrial disputes, of unemployment, of wages, and of retail prices (in the case of the last four the data are by no means complete). The income tax returns furnish information about income other than wages. To the second category belong: reports of banks, of the stock exchange, of joint-stock companies, of trade unions, voluntary censuses of wages and hours of labour, and such estimates of price changes as those of the *Economist* and of Sauerbeck. But most of these unofficial figures are necessarily partial and incomplete.

(2) *Methods of Statistics.*—Only a few of the commonest can be mentioned here.

(i) *Diagrams.*—A series of figures can often be presented readily to the eye by means of a diagram. The commonest kind shows the relation between two quantities, say the change of the population with the lapse of time, by representing equal periods of time by equal lengths along a horizontal line (the base-line), at points along which, corresponding to each year, are erected vertical lines proportionate to the number of the population. The vertical lines can be omitted and the numbers represented by the points at their upper ends, which may be joined by straight lines. The base-line should always be shown. In certain cases it is convenient to use a logarithmic scale for one of the quantities. If the population is so represented, equal vertical heights will represent not equal *numerical* increases but equal *proportionate* increases.

(ii) *Averages.*—It is often convenient to give a large number in the form of an average. Thus, if we say that the ages of a company of 80 persons totalled 2400 years, we do not receive so clear an idea as if we said that their average age was 30 years. (*a*) *Arithmetic mean or average.* This, the best-known kind and the one illustrated above, is obtained by adding together all the determinations of a quantity and dividing by the number of determinations. The arithmetic average of n quantities $a_1, a_2, \ldots a_n$ is $\frac{a_1 + a_2 + \ldots + a_n}{n}$. (*b*) *Weighted average.* Sometimes the determinations are not all of equal value. For instance, in an index-number, showing the percentage change of prices as a whole, a change in the price of truffles should not have the same influence on the result as an equal change in the price of wheat. Each quantity in taking the average can be multiplied by its *weight*, that is, a number proportionate to its importance. The result is a *weighted average.* If the weights are $w_1, w_2, \ldots w_n$, the average is $\frac{a_1w_1 + a_2w_2 + \ldots + a_nw_n}{w_1 + w_2 + \ldots + w_n}$. (*c*) The *geometric mean or average* of n quantities is the nth root of their product, i.e. $(a_1a_2 \ldots a_n)^{\frac{1}{n}}$; the logarithm of the geometric mean is the arithmetic mean of the logarithms of the quantities. Its chief advantage is in constructing index-numbers; it gives a result independent of the year chosen as base. (*d*) The *median* is sometimes more useful than the arithmetic average. If the determinations are arranged in order of magnitude, the middle one if they are odd, or the mean of the middle ones if they are even, is the median. It is thus determined by mere counting. (*e*) The *mode* may be defined as the most frequently occurring value of a quantity. If a series of determinations be arranged in groups of those falling between equidistant values, that group which contains the greatest number of determinations contains the mode; it may then be divided into smaller groups until the mode is defined with desired accuracy. Both the median and the mode, unlike the arithmetic and geometric averages, are unaffected by extremely large or small values among the determinations.

(iii) *Accuracy.*—No quantity, physical, astronomical, or demographical, can ever be determined with absolute accuracy. Nor, for practical purposes, need it be so. An accuracy of one per thousand is usually superfluous: $\frac{1}{1000}$ of a week's wage is only ½*d*. In any case the degree of accuracy should be stated; otherwise the estimate is incomplete. To state a quantity in exact figures where these are not known with certainty is positively inaccurate. There are two classes of errors, unbiased and biased. The first class is just as likely to be in excess as in defect, and the more determinations there are made the less is the probable error. The second class is due to some cause in the method of determination that tends to make the errors all in one direction.—BIBLIOGRAPHY: A. L. Bowley, *Elements of Statistics*; *Elementary Manual of Statistics*; D. C. Jones, *First Course in Statistics*.

Statius, Publius Papinius, Roman poet, was born A.D. 45, and died A.D. 96. His father was a poet and schoolmaster, and Statius began to write verses at an early age. He became court poet to Domitian, and was by inference an enemy of Martial, whom he at least rivalled in his gross flattery of the emperor. Little is known of his life, which was mainly spent at Rome; but he returned to his native city of Naples some two years before his death. Statius's most imposing work is the *Thebais*, an epic poem in twelve books dealing with the struggle between the brothers Eteocles and Polynices. This poem took twelve years to compose; unfortunately the converse of Sheridan's *mot* that "easy writing 's curst hard reading" is not true. The *Thebais* is difficult reading; in order to appreciate its merits it is necessary to take the extreme step of reading some Valerius Flaccus and Silius Italicus. Statius began to write another epic, the *Achilleis*, but only one book and part of another remains. The most pleasing poems of Statius are contained in his *Silvæ*, a collection of more or less impromptu short poems. There are thirty-two pieces in all, twenty-six of them being in hexameters and six in lyric metres. They have a certain amount of freshness and vigour. The most successful of them is the *Invocation to Sleep*. After the revival of learning it was not uncommon for scholars to rank Statius as being just below Virgil. Even Scaliger makes this unpardonable error. Statius owed some of his fame to the quite unfounded story that he became a Christian. His shade is interviewed at some length in the twenty-first canto of the *Purgatorio* of Dante.

Statute, a law proceeding from the Government of a state: a written law; in Britain, an Act of Parliament made by the sovereign by and with the advice of the Lords and Commons. Some ancient statutes are in the form of charters or ordinances, proceeding from the Crown, the consent of the Lords and Commons not being expressed. Statutes are either public or private (in the latter case affecting an individual or a company); but the term is usually restricted to public Acts of a general and permanent character. Statutes are said to be *declaratory*, declaring the law as it stood before their passing; *remedial*, to correct defects in the common law; and *penal*, imposing prohibitions and penalties. In the event of ambiguity a penal statute is to be interpreted strictly, a remedial statute liberally. The term *statute* is commonly applied to the Acts of a legislative body consisting of representatives. In monarchies not having representative bodies, the laws of the sovereign are called *edicts*, *decrees*, *ordinances*, *rescripts*, &c.

Staunton, Howard, British Shakespearean scholar and chess-player, born 1810, died 1874. He was educated at Oxford, and settled in London as editor of the *Chess Player's Chronicle*. He defeated M. St. Amant (1843), the chess champion of Europe, and he subsequently published various treatises on chess, as the *Handbook* (1847), the *Companion* (1849), *Chess Tournament* (1852), and *Chess Praxis* (1860). He was an eminent Shakespearean scholar, and published an edition of the *Plays and Poems* (three vols., 1857–60), a facsimile of the (1623) First Folio, and *Memorials of Shakespeare* (1864). He was also the author of *The Great Schools of England* (1865).

Stavanger (stå-vång′ėr), a seaport-city of Norway, on the Stavanger branch of the Bukke Fjord. It is one of the oldest towns in Norway, and has a cathedral, one of the finest Gothic monuments in the country, founded in the eleventh century by Bishop Reinald. It has some manufactures, a good harbour, and an active trade in connection with fishing. Pop. 44,000.

Stavro′pol, a Ciscaucasian province of Russia. It comprises the Stavropol Plateau (2000 to 2500 feet altitude), watered by the Kuban, Terek, and Kuma, and served by a branch (93 miles) of the Vladikavkaz Railway (Rostov-on-Don–Baku, 819 miles) from Kavkazkaya to Stavropol, the capital. Millet, oats, maize, and the sunflower (for oil from the seeds, the stalks being used for potash-making) are raised. Horses and cattle are bred. Area, 23,500 sq. miles; pop. (1914), 1,312,000 (90 per cent Russian).

Stavropol, a town of Russia, capital of the province of Stavropol. It is fortified, and has large flour-mills (normal output, 300,000 tons per annum), and a trade in cattle, leather, &c. Three fairs are held annually. Pop. 60,000.

Stawell, a town and railway junction of Victoria, Australia, on the Melbourne-Adelaide trunk line. It is the centre of the Pleasant Creek gold-field. Pop. 4400.

Stay, in ships, a large, strong rope, extending from the upper end of a mast down to another mast, or to some part of the vessel, with the object of lending support to the mast to whose top it is attached. Those leading forward are called fore-and-aft stays, and those leading down to the vessel's sides and pulling a little backwards are called back stays. A sail extended on a stay is a stay sail. In large vessels there are several of these of a triangular shape. *To stay* is to tack or bring the ship's head up to the wind for going about; *to miss stays* is to fail in the attempt to go about. *In stays* or *hove in stays* is the situation of a vessel when she is in the act of going about.

Steam. The compound H_2O is a substance which is familiar in each of the three possible physical states of matter. It is known in the solid state as *ice*, in the liquid state as *water*, and in the gaseous state as *steam.* The simpler phenomena attending the conversion of water into steam may be illustrated as follows. Let a cylinder contain 1 lb. of water just above freezing-point, and let it be fitted with a weighted piston, which we may suppose frictionless, so that the water is subjected to a definite pressure, say p lb. per square inch. If heat is supplied to the water, the temperature will rise, but the piston will remain stationary, except for the slight expansion of the water, until the temperature reaches a certain point, say t° F., depending on the pressure p, and called the *boiling-point* of water for that pressure. The effect of supplying additional heat to the water is quite different after this point from what it was in the first stage. The water shows no further increase in temperature by the thermometer, but steam begins to form, and the piston begins to rise in the cylinder; if sufficient heat is supplied, it will continue to rise until the whole of the water is converted into steam. During this stage, water and steam exist in contact with each other in a state of equilibrium at the same temperature and pressure. The pressure p is called the *vapour pressure* of water at temperature t, and steam at that temperature and that pressure is said to be *saturated.* The temperature of saturated steam is therefore definitely known when the pressure is given, and conversely; and this fixed relation between saturation pressure and temperature is quite independent of the relative amounts of the water and steam which are present. When the whole of the water has just been evaporated, it exists in the form of saturated steam. The heating may be continued still further at pressure p, in which case the steam becomes *superheated*, and its temperature rises beyond the saturation temperature t corresponding to the pressure p.

The heat required to convert 1 lb. of water at t° into saturated steam at t° is called the *latent heat* of steam at t°. If the water is given at freezing-point, a preliminary quantity of heat (*sensible heat*) is needed to raise it to t°. The sum of these two quantities of heat is called the *total heat of steam* at t°. Regnault, the first experimenter to make a thorough investigation of the properties of steam, found for the total heat H of steam at t° C. the formula $H = 606{\cdot}5 + 0{\cdot}305t$. To find the *latent heat* at t° C., subtract the *sensible heat*, which is t, taking the specific heat of water as unity; hence the latent heat $L = 606{\cdot}5 - 0{\cdot}695t$. The latent heat of steam at 100° C. is therefore $606{\cdot}5 - 69{\cdot}5 = 537$; so that 5·37 times as much heat is required to evaporate 1 lb. of water at 100° C. as is required to raise it to 100° C. from freezing-point. Regnault's formula for the latent heat L has been found by subsequent experimenters to give too large values at low temperatures; Griffiths (1895) finds $L = 598{\cdot}0 - 0{\cdot}605t$.

When water is heated in a vessel open to the air, water vapour, i.e. steam, is given off gently until the water reaches that temperature at which the saturation pressure of its vapour is equal to the pressure of the atmosphere. The water then boils, and evaporates on the addition of heat, without change of temperature. When the boiling-point of water—or any other liquid—is referred to without mention of the pressure, a standard pressure is understood, usually 760 mm. of mercury, or 14·7 lb. per square inch. At this pressure, water boils at 212° F.; and at pressures not far from this, the boiling-point rises at the rate of about 10° F. for every additional 3 lb. per square inch of pressure.

It has already been mentioned that when 1 lb. of water substance is given at temperature t and at the saturation pressure p for that temperature, it may exist in the form of a mixture of water and steam in any proportions. Moreover, there may either be a definite surface of separation between the liquid and the gaseous phases, or the water may be *atomized*, i.e. in an extreme state of division, and thoroughly mixed with the steam. In the latter case, the mixture is called *wet steam*; and saturated steam is by contrast called *dry steam.* If the wet steam consists of q lb. of dry steam, and $1 - q$ lb. of water, q is called the dryness fraction of the mixture. If L is the latent heat of dry steam at t°, clearly the latent heat of wet steam is qL. Dry steam is invisible; so that steam issuing from the spout of a kettle can only be seen when it is mixed with particles of water.

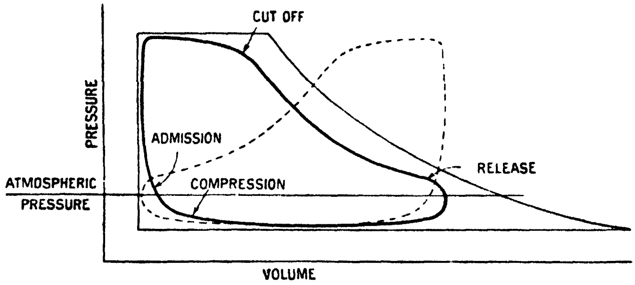
Until recent years, very little accurate information about the properties of superheated steam was available. This state of affairs was due to the difficulty of assessing the heat contents of a substance which has a stratified flow and consequently may exist in the superheated form in the centre of a pipe, and yet be saturated and possibly wet at the outside of the stream.

When steam is subjected to change of pressure in a nozzle, a series of peculiar actions takes place, and at some points of the stream the steam may exist at a temperature lower than the saturation temperature for the particular pressure. Steam in this condition is said to be *supersaturated.*

The properties of steam have been investigated experimentally and theoretically by Professor H. L. Callendar, and the results tabulated for the use of engineers. For the purpose of the calculations, the properties of steam were represented by the simplest equations which could be chosen to satisfy the laws of thermodynamics, and at the same time to agree with experiment over the range required in practice. The theory was successfully subjected to a searching test, the values of the saturation pressure at a given temperature being deduced by calculation from the theory, and found to agree with the observations of Regnault.—BIBLIOGRAPHY: W. Inchley, *Theory of Heat Engines*; W. E. Dalby, *Steam Power*; H. L. Callendar, *Steam Tables*; L. S. Marks and H. N. Davis, *Steam Tables.*

Steam-engines. The earliest work in which there is any reference to the use of steam to cause rotary motion is the *Pneumatica* of Hero, written in Alexandria about 130 B.C. In that work an æolipile was described in which the steam issuing from jets on a hollow sphere caused reactions by which the sphere was rotated. The device had no practical significance, but it is interesting to note that the first steam appliance described in any literature has been the last to be applied practically. From that time many workers introduced new devices using steam as the motive power, and among these pioneers may be mentioned della Porta (1601), de Caus (1615), Branca (1629), and the Marquess of Worcester (1663). The products of their labour, though indicating the trend of thought and the progress towards practical service, remained little more than philosophers' toys. To Thomas Savery, who in 1698 constructed a practical pumping-engine, must be given the credit for the first real practical advance. In the appliance he invented, the condensation of a cylinder full of steam was used to create a suction action drawing water from the low-level pipe into the cylinder. Once the suction valve was closed the application of steam pressure was made to force the water out of the cylinder through the delivery valve. The water-raising device invented by Savery was of such merit that pumps working on the same principle are manufactured and sold in great quantities to this day. The next stage in the evolution of steam power was due to Newcomen (1705), who, with his assistant Cawley, produced an engine in which the motion obtained from the piston was given to one end of an oscillating beam and so communicated to the other end to cause the reciprocation of the rods of the pumps. Steam was used in the engine merely to raise the piston against the atmospheric pressure, and was then condensed. The air pressure above the piston and the vacuum, created by the condensation of the steam below it, provided the useful pumping forces. No attempt was made to use higher steam pressure than that required to overcome the atmospheric pressure. Some of these engines were in active use until recent years.

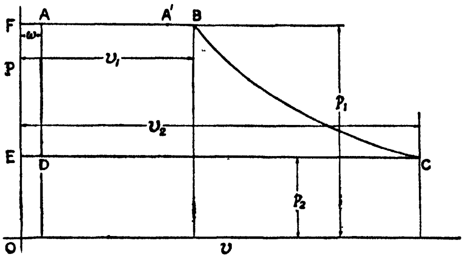
The next stage in the perfection of steam-engines was the most productive of all, for to James Watt, whose work followed on that of Newcomen, we owe the greatest debt of gratitude that civilization owes to any inventor. While it is not strictly true to say, as is frequently done, that Watt invented the steam-engine, it must be owned that the improvements he introduced were of so outstanding a nature as to place his work in quite a different class from that of any other inventor. He started his study of the subject with the aid of Professor John Anderson's model of a Newcomen engine in Glasgow University at a time when steam was wastefully applied and the steam-engine was still a clumsy and imperfect device. The genius of Watt, whose work marks the beginnings of modern industrial activity and progress, was shown by his masterly diagnosis of the essential defects of design in the Newcomen type of engine. The alternate heating and cooling of the cylinder, by the entering steam and the cold-water supply, meant the waste of large quantities of steam. This Watt prevented by condensing the steam in a vessel separate from but connected to the cylinder. The same vacuum was produced below the piston, but not only were the cylinder walls kept hotter than before, but Watt added steam-jackets to the cylinders to keep the temperature of the walls at the highest possible value. He employed steam pressure to force the piston down, instead of the atmospheric pressure used in the Newcomen engine, and improved the power of an engine of any cylinder dimensions by making the engine *double acting.* By that term is meant the performance of the steam-cycle on both sides of the piston. Watt devised a crank motion to produce rotation from the reciprocating movements of the piston, but finding the application of that old mechanism, the crank and connecting-rod, to the steam-engine had been covered by patent by some so-called inventor, Watt had to alter his design. The sun and planet motion introduced by Watt gave the same transformation of reciprocating into rotating motion as the crank and connecting-rod. This introduction was only an expedient to get over the impudent claims of the trifler, and when by lapse of time it became possible to use the crank and connecting-rod mechanism Watt resorted to that course. To Watt is due also the addition to the engine mechanism of a fly-wheel designed to equalize the motion and carry the crank over the dead points when the piston is at the end of the stroke. The governor, which controls the admission of steam into the cylinder in such a way as to keep the engine speed constant, was another of the many changes introduced by Watt, who also devised the indicator (q.v.) with which to test the change of steam pressure during the performance of each cycle. Prior to Watt's time steam was introduced during the performance of the complete stroke. He introduced the system of admitting steam for a portion of the stroke only, and then allowing it gradually to decrease in pressure for the remaining part of the stroke. This action, known as expansive working, is productive of a great gain in economy, and is used in almost every steam-operated device today. It may be said, indeed, that almost every device introduced into the construction of a steam-engine which makes for economy was the product of Watt's brain.



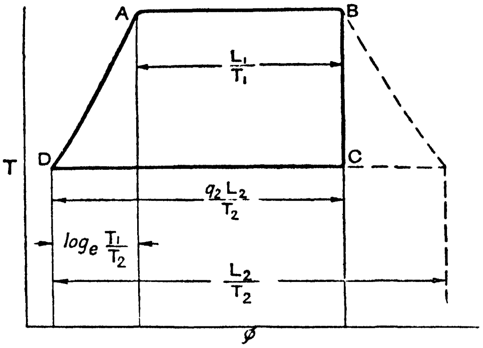
The cycle of operations of a steam-engine is quite simple. Steam is admitted for a certain part of the stroke and then is *cut off*. From this point no steam is allowed to enter or leave, but that already in the cylinder has sufficient pressure to force the piston along in its stroke, and thus more and more space is left for the steam, and as the volume increases the pressure falls. Towards the end of the stroke, when the pressure has reached some low value, the steam is allowed to escape to the condenser. The pressure falls quickly to that on the condenser, which is much below the atmospheric pressure, and the steam is swept out of the cylinder as the piston moves back to its original position. Were this action performed during the whole stroke, the piston would reach the end of the stroke at very high speed, and the sudden stoppage would cause a considerable amount of shock to the mechanism. To prevent this taking place, the exhaust operation is stopped before the end of the stroke is reached, and any steam remaining in the cylinder is compressed, so that the mechanism is brought to rest much more slowly before the direction of motion is reversed. These actions take place on the two sides of the piston in turn, steam being admitted and expanded on the one side of the piston while it is being exhausted from the other side.

In the diagram the cycle of operations has been drawn out, the theoretical diagram being shown by the outside lines, while the inner figure with all the corners rounded off indicates what would be obtained from a good actual engine. The lines showing admission of steam and exhaust represent steam at the full boiler pressure and at the condenser pressure respectively. In an actual engine a certain drop in the admission pressure takes place as the piston moves on, due to the necessity for passing the steam through the restricted ports, and the pressure on the cylinder never falls to that on the condenser for a similar reason. The start of the exhaust operation (marked *release* on the figure) and the admission are always just before the end of the stroke. The cushioning actions required at the end of the stroke are obtained by the trapping of some of the exhaust steam behind the piston, and something like the normal condition is indicated in the diagram. The corresponding diagram for the operations taking place at the other end of the cylinder is shown dotted. To carry out this cycle of operations it is necessary to have valves which can not only be opened to steam and exhaust at specified times, but may be kept closed for periods. The simple slide valve, the invention of Murdock, James Watt's assistant, consists of a simple box with wide walls. The steam admission and exhaust periods are controlled by having suitable widths. The relationship between the dimensions and the actual steam distribution is discussed in the article *Valves and Valve Gears* (q.v.). Steam is supplied to the space surrounding the valve known as the steam-chest, and the valve moves to and fro over the three ports cut on the valve seat. The two end ports are connected by channels through the cylinder metal to the actual spaces behind the piston, and the centre port is used to conduct the steam away from the engine after use. It carries the exhaust steam out to the atmosphere or into a condenser. As the valve moves backwards and forwards, it uncovers the ports to steam in turn, and also connects each port with the exhaust through the inside of the valve. Valves are not always of the flat form described, but may be made with cylindrical faces. In such a type the steam pressures act in all directions towards the cylindrical faces and balance each other. In use these valves are thus not subject to heavy pressure loads, and are consequently easy to operate, but they leak very badly. A valve for a vertical engine frequently has a small piston connected to it and situated above it, which, acted on by the steam pressure, helps to relieve the valve gear of the actual weight load of the valve.

Steam-engines may be governed by either of the two processes, varying the steam pressure or altering the period of steam admission. If the engine is governed by the first or throttling process, the curve showing steam used per hour plotted against horse-power takes the form of a straight line, known as the Willans line, after P. W. Willans, a careful experimenter who did much to produce engine designs suited to the varying requirements met with in modern practice.



A steam-engine has two distinct functions to perform, the first being the conversion of heat into work, and the second the transformation of the reciprocating motion obtained in the cylinder into a rotating one for the crank-shaft. There are thus two efficiencies, the one thermal and the other mechanical, about which we must have some knowledge. In any type of engine using any medium for the conversion of heat into work there is a distinct limit imposed by nature upon the magnitude of the conversion. No more heat can be transformed into work than the fraction got by dividing the temperature range by the absolute temperature of inlet (see *Thermodynamics*). Were an engine perfect, no greater percentage of the heat available than that indicated could be obtained. But a steam-engine is not suitable for the attainment of even so high an efficiency as that referred to. It is therefore customary to compare the efficiency of heat conversion in a steam-engine with what might have been attained with an engine working on a perfect steam cycle rather than on the Carnot basis. The operations in this perfect steam cycle are admission, expansion, and exhaust of the steam. The cycle may be drawn for study on the pressure-volume basis or on that of temperature-entropy (see *Entropy*). All that one needs to remember for an understanding of the concept of entropy is that, whenever heat is received or rejected, there is said to be a change of entropy, which is measured as the ratio of the magnitude of the heat transfer to the absolute temperature at which the transfer takes place. Any area on a diagram where temperature is plotted against entropy represents work units just as the area on a pressure-volume diagram does. Both are used in the study of heat engines. Each has a useful sphere, which depends upon the character of the questions under consideration; the comparison of the two diagrams is shown in the figures side by side.



The area ABCD in each case represents the perfect steam-cycle, which is known as the Rankine or Clausius cycle. This cycle is the standard by which all steam-cycles and the efficiencies of actual engines are assessed (see *Efficiency*).

The mechanical efficiency is determined from a comparison of the indicated and brake horse-power. The indicated horse-power is that obtained from the work performed by the varying steam pressures in the engine cylinder. The area of the pressure-volume or indicator diagram (see *Indicator*) is the work done each cycle. From it the work done each minute can be calculated if we know the dimensions of the piston on which the pressures act, the distance it moves, and the number of movements or strokes per minute. James Watt defined a horse-power as that rate of working at which 33,000 foot-pounds of work are done per minute. From the value of this unit, and the total work done per minute by an engine, the horse-power determination is simple arithmetic. The brake horse-power of an engine is the useful power available at the engine crank-shaft, and may be determined with the use of a brake, a dynamo and electrical power installation, or a torsion meter. With the improvement in knowledge of the properties of materials and in workshop processes, there have been great reductions in the friction within an engine, and consequent increased mechanical efficiencies.

The change in design of engines has followed the regular course of the needs of the extended applications of power. In early days engines were only used for pumping water, and the speeds of running used were suitable for that purpose. Later it was necessary to drive rotating machinery, and the speeds of running were changed at periods to suit the individual requirements. Mills needed slow-running engines to drive the shafting; for electric power stations, when the engine was to be coupled directly, the speeds had to be high; and other uses imposed other conditions. Many of these uses have now ceased to be of importance, for other and more suitable prime movers have become available for the service. To give an idea of the particular features of each type, some description will be given later of the outstanding characteristics of each.

Sturdiness must be the outstanding characteristic of engines put in charge of unskilled labour, and of those working under very rough conditions. Elaborate and expensive types of engines may suit conditions where fuel is so costly and labour so dear that any expedient to obtain economy must be resorted to. Where fuel is cheap and the working day short, there is no necessity for anything but the simplest and least expensive type of plant. What the engine lacks in economy may be compensated for by the other factors. It is the total cost of running, not fuel costs only, wages, or the efficiency of the engine, that is the important consideration in power generation. Condensers may or may not be installed, according to the general economic conditions of the whole scheme. Their addition to the first cost is very soon recovered in the saving of steam, as the non-condensing engine uses from 20 to nearly 50 per cent more steam than a condensing one. For ordinary mill driving engines of the horizontal type running at comparatively low speeds are to be preferred, but there are cases where floor space is limited, or where high speeds are needed, when they would give place to the faster running vertical type.

There are many methods of improving the economy of a steam-engine, such as increasing the speed of running, jacketing the cylinders and introducing steam from the boiler to keep the cylinder temperatures high, superheating the steam before entry, or increasing the number of cylinders. All such changes, within certain definite limits, have shown gains which have been accounted for in many different ways. The methods of producing this economy are supposed by some writers to be of such a nature that one is forced to the belief that they do not like simple explanations, but hanker after something which is involved. In the article *Missing Quantity* there is a reference to the fact that in actual working more steam always passes through a steam-engine than is shown by the indicator diagram as taking part in the useful operations. It has often been contended that this difference is due to the hot steam entering the cold cylinder and condensing on the walls. For this theory to be correct it must be assumed that the walls are colder than the steam. In actual experiments, however, where the walls have been kept purposely at higher temperatures than the steam at any time, missing quantities have been noticed and measured. The theory of initial condensation, the subject of many elaborate calculations, does not therefore account for all the missing quantity. There must be some other action going on which accounts for the loss. Callendar and Nicolson, some thirty years ago, showed conclusively that the major part of the missing quantity was due to leakage past the valves, and that the temperature of the cylinder walls only went through a certain small range of temperature variation. They measured the temperature cycles under many different conditions, and established a method of estimating the magnitude of the loss through initial condensation from the indicator diagrams and the average temperature of the cylinder walls, as obtained by inserting an ordinary mercury thermometer into a hole drilled in the metal. They established laws of valve leakage which have since been frequently verified.

It is to this missing quantity, composed of a certain limited amount of condensation and a much larger amount of valve leakage, that one must look for any understanding of what goes on when an economy change is produced in an engine's running. Anything which raises the temperature of the valve seat, reduces the pressure difference between the inside and outside of the valve, alters the speed of movement of the valve, or keeps the steam in a very viscous state, has the effect of reducing the steam consumption of an engine.

For those types of steam-engine in which four separate valves have been used for the admission and exhaust of steam at each end of the cylinder high economies of running have been experienced. This has been accounted for by many people as due to the sudden actions of closing and opening, but there is little question that the advantage is due to the fact that steam and exhaust operations are performed with the use of separate valves. Leakage actions are in that way considerably reduced. The same remarks apply to the central exhaust or uniflow type of engine. In this type steam is passed into the cylinder through an ordinary trip-operated valve, and is exhausted through openings at the centre-line of the cylinder which are uncovered by the movements of the piston. The temperature gradient of the cylinder wall from inlet to exhaust remains practically unaltered all the time, and the temperature relationships between steam and wall must be supposed to be conducive to low amounts of condensation. In this case, as in all others, the tightness of the valve is the greatest safeguard against loss of steam. As elastic-seated valves have been introduced into some of these engines, the fact that a valve does leak seems to be beginning to be recognized. A simple slide valve may be scraped to give perfect tightness when it is stationary on the valve seat, but once movement begins leakage is shown. This takes place through the narrow crannies cut through the oil and water film on the valve seat by the microscopic projections on the supposed flat valve. Wet steam has a very low viscosity. As its dryness is increased the viscosity rises, and when the superheated condition is reached it attains quite high values. Any action which prevents the deposit of water on the valve seat or keeps the steam dry or the temperature of superheat high thus reduces the amount of leakage.

Portable and Semi-portable Engines.—This type has usually a simple single-cylinder engine mounted upon the top of the boiler from which it receives its steam supply. Sometimes a compound engine is fitted with the cylinders on the top of the boiler and to each side of the centre-line. The engines are usually of very simple and solid construction, and depend for their economy in some cases on the use of superheated steam. Each unit actually comprises a complete power set. Remarkably good steam economy has been obtained with some makes of these plants, and they find a popular field of service in agricultural work. They are sometimes mounted on wheels to facilitate their removal to and from the place where they are to be used. Engines similar to these in general construction are generally referred to as semi-portable, though they may on occasion be installed in a fixed position.

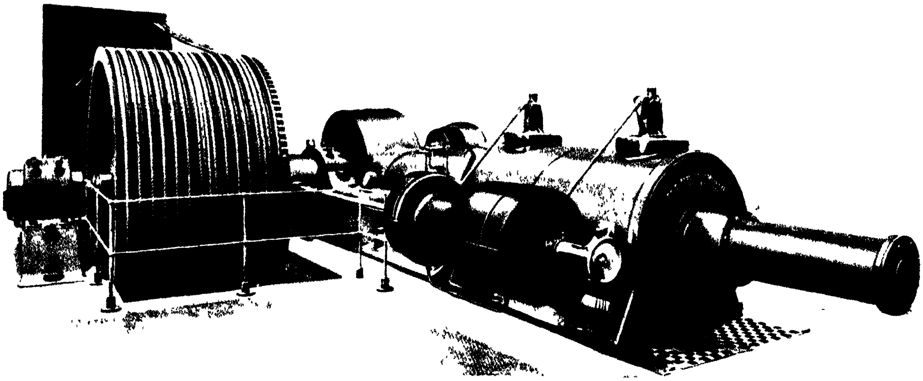
Horizontal or Mill Engines.—In this type the most common arrangement is to have the first part of the expansion process carried out in a small cylinder, known as the high-pressure cylinder, after which the exhaust steam is carried away by pipes as the supply steam for the second or low-pressure cylinder. The ordinary steam cycle, cut-off, expansion, exhaust, and compression is carried out in each cylinder. The engines of this type usually have the centre-lines of the cylinders running parallel to each other, the whole structure having the form of a U, with the crank-shaft and fly-wheel forming the connecting-link between the side arms. A common type of engine has four separate valves for each cylinder. These are operated from side shafts driven from bevel or worm gearing on the crank-shaft. The valves may be of the simple piston-plug type, rocking, or double-beat form. It is customary to regulate such engines by varying the point of cut-off. For the achievement of this the valves are opened mechanically, but closed by springs or dash-pots at a time fixed by the momentary speed of running changing the position of the governor balls. Such engines are run at speeds suitable for the driving of many types of industrial machines and shafting, and for the rope drives in the operation of cotton-mills.

Uniflow Engines.—In this form of engine, which is constructed to carry out all the expansion actions in each single cylinder, the exhaust valves take the form of openings cut in the middle of the cylinder wall, which are uncovered by the piston moving over them. The inlet valves are usually of the trip-operated type. Because of the nature of the exhaust arrangements, the compression of the steam is carried out during a large proportion of the stroke, and very high pressures are attained. Very good results have been obtained by the use of this type of engine, and considerable progress has been made in its application to other purposes than mill-driving, as, for example, in the smaller electric power stations, and locomotives have been designed which make use of them.

High-speed Engines.—These were developed by Belliss and Morcom, Willans, Howden, and others to meet the demand for an engine which could be coupled direct to electric generators or other high-speed plant. The early troubles due to lubrication were overcome by R. K. Morcom by introducing the oil under pressure, after which extensive development took place. A large part of the field of service of these engines has been filled by the introduction of steam turbines (see *Turbines, Steam*).

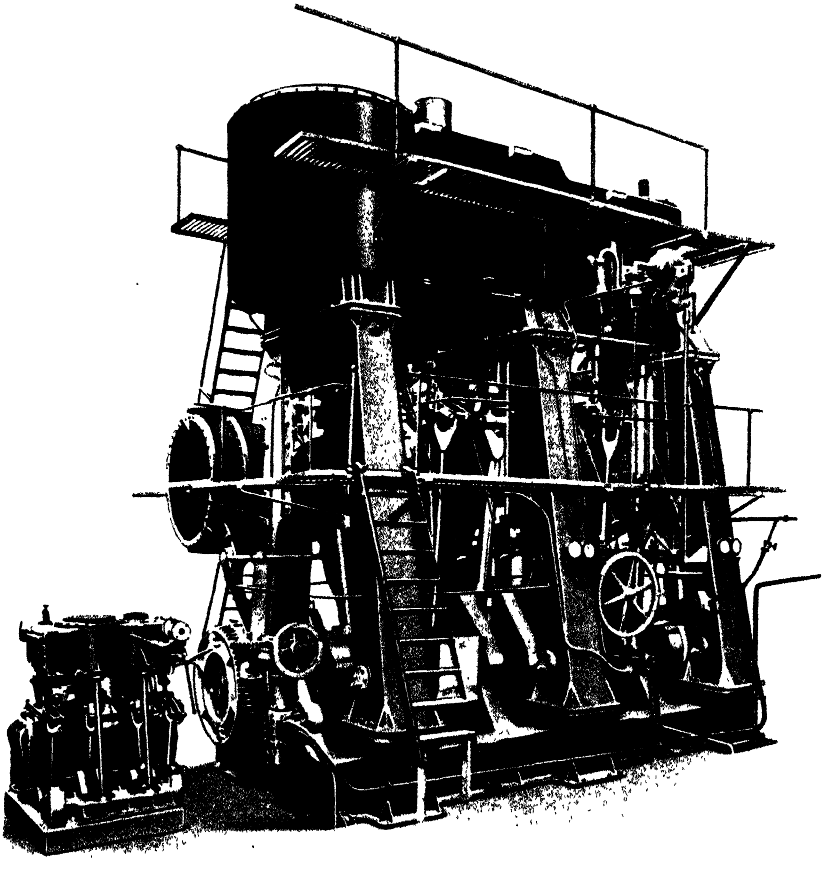
Marine Engines.—In this field the steam-engine has been largely replaced by steam turbines for passenger boats, and also by the oil-engine in some other services, but there is still a large production of steam-engines for marine propulsion. Many factors must be considered in the determination of the most suitable plant for any given installation, and the final decision is a very involved question. In early days the introduction of compounding, that is, dividing the steam expansion processes up into separate operations in two or more cylinders, meant a considerable gain in economy. Compound, triple, and quadruple expansion engines gave steam consumption results per horse-power less and less as each

STEAM-ENGINES



Four-valve Back-pressure Engine, an adaptation of the Uniflow engine

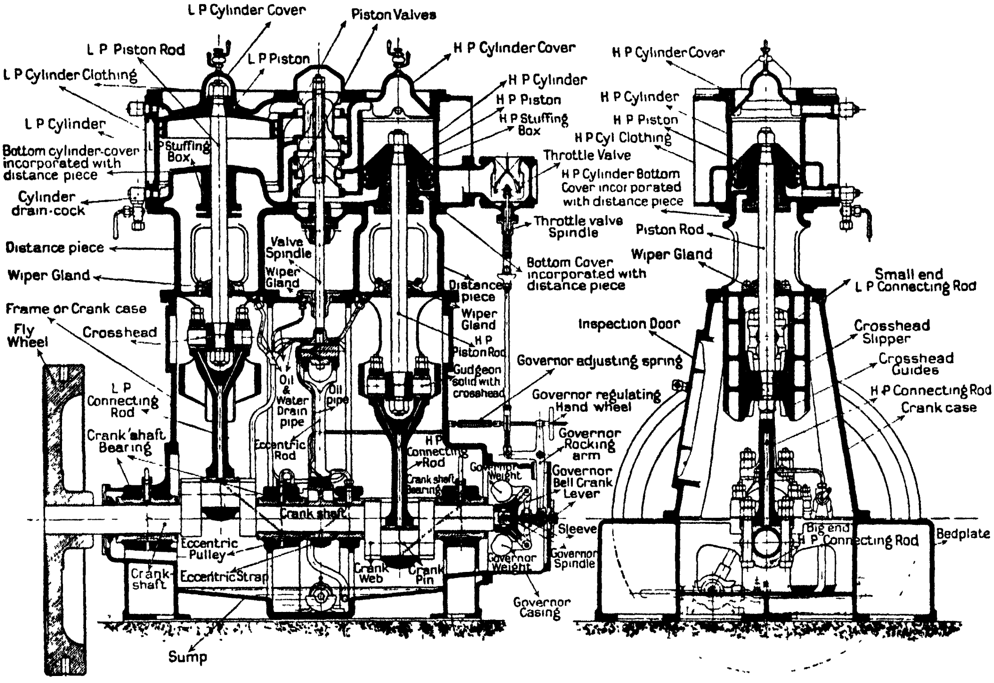
By permission of Messrs Cole, Marchent & Morley, Ltd



Main Propelling Engines of S.S. *Clan Graham.* Cylinders 27" × 44" × 73" × 48"

By permission of Messrs McKie & Baxter, Govan

cylinder was added. They were all suitable for the direct operation of screw-propellers at speeds suitable for the attainment of the best efficiency of propulsion. As a steam-engine can be made reversing and also workable at low loads by the simple expedient of linking up the valve gear (see *Valves and Valve Gears*), it has proved eminently suitable for the heavy service of continuous running necessary on a steam-vessel. The Stephenson gear, with open or crossed rods, proved the most popular type in these engines. With a separate valve gear for each cylinder it was possible to vary the proportioning of the total power between the cylinders to suit economical working. To prevent the necessity of resetting all the operations to the normal before reversal, the mechanism to cause the gears to take their reverse running positions has always been arranged so that the individual setting of the valve gear for each cylinder does not in any way affect the steam distribution when running reversed. This is done by carrying the movement for reversal through weigh bars on the weigh shaft to the link motions. If the weigh bar is set so that it is in line with the link when running ahead, and at right angles to it when going reversed, the desired arrangement is obtained.

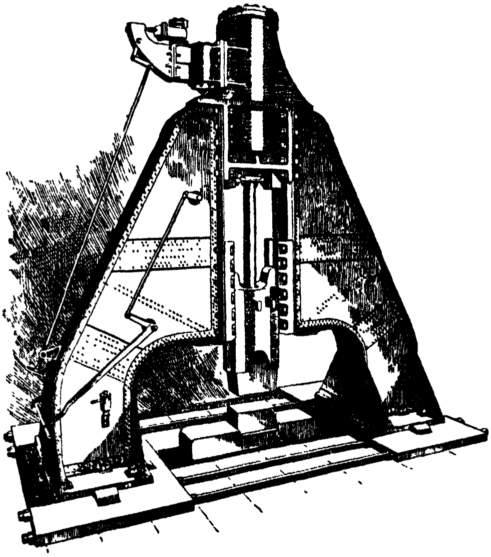


Belliss and Morcom Patent Self-lubricating Compound Steam-engine

Locomotive Engines.—These have usually two simple horizontal or almost horizontal cylinders working the usual piston, piston-rod, crosshead, connecting-rod, and crank mechanism. In the case of inside cylinder engines, the connecting-rods work on a crank-shaft with cranks at right angles. When outside cylinders are used, the connecting-rods work on crank-pins on the driving-wheels. The valves may be of the piston or the simple flat type, operated usually by Walschaert or Stephenson gear. When inside cylinders are employed, the two flat valves commonly work in the same valve-chest. Each cylinder consists of a separate engine, and both work non-condensing, the exhaust steam being passed through a blast-pipe below the funnel to create the draught for the boiler. Some part of the exhaust steam is sometimes used for feed-water heating.

Steamer (or Logger-head) Duck (*Tachyeres cinereus*), a species of marine duck from 35 to 40 inches in length, distinguished by its small, short wings, and the swiftness with which it paddles over the surface of the water. It is found in Patagonia and the Falkland Islands.

Steam-hammer, an appliance used in steel-works and engineering factories, by the blows of which hot metal may be pounded into any desired shape. The sizes of these tools are usually specified in terms of the mass of the falling weight. The effective blow is of very great magnitude but is expended in a moment, and produces effects similar to those caused by the application of a dead load of about one hundred times that of the falling mass. They are made in two forms, the overhanging type and the arch type, the reference being to the shape of the frame. The illustration shows the construction adopted by some makers for the heavy machines. The steam cylinder is situated at the top of the frame, and in it is a piston with suitable ring packing and provided with a piston-rod which is connected at the foot to the hammer head. The steam stop valve is controlled by a hand-wheel on a long shaft, and the valve of the cylinder is moved to and fro to suit the actions required by the operation of a simple hand-lever. The head moves in guides on the frame, and below it an anvil is provided. In the machine illustrated the frame is a girder structure composed of angle iron and steel plate. The foundations of heavy plant of the steam-hammer type must be given great consideration because of the possibility of causing vibration troubles in neighbouring property.



Steam-hammer, 12-ton Size
By permission of Messrs. B. & S. Massey, Ltd.

Stearic Acid ($C_{18}H_{36}O_2$), one of the most important and abundant of the higher fatty acids. It may be obtained by hydrolysis of vegetable and animal fats, such as beef and mutton suet and hard oils generally, by means of caustic soda or hydrochloric acid; or it may be prepared by reduction of oleic acid. Stearic acid, which is odourless, tasteless, insoluble in water, but soluble in alcohol, forms white scaly crystals melting at 69° C. With alkalis and metallic oxides it forms salts known as the stearates. The sodium and potassium salts constitute the chief ingredients of soap, white curd soap, for example, being composed mainly of sodium stearate. The acid burns like wax, and along with palmitic acid is used in making candles.

Stearin, or **Tristearin,** a glyceride, $C_3H_5 \cdot (C_{18}H_{35}O_2)_3$, occurring in suet and tallow or the harder ingredients of animal fats; *palmitin* and *olein,* also glycerides, being the softer ones. It is obtained from mutton suet by repeated solution in ether and crystallization, or from tallow by pressing between hot plates and subsequent crystallization from ether. In either case it usually retains small amounts of palmitin. The commercial product becomes rancid on exposure to air. It has a pearly lustre, is soft to the touch, and is not greasy. It is insoluble in water, but soluble in hot alcohol and ether. When treated with superheated steam, it is hydrolyzed to *stearic acid* and *glycerine,* and when boiled with alkalis yields a *salt* or *soap* and glycerine.

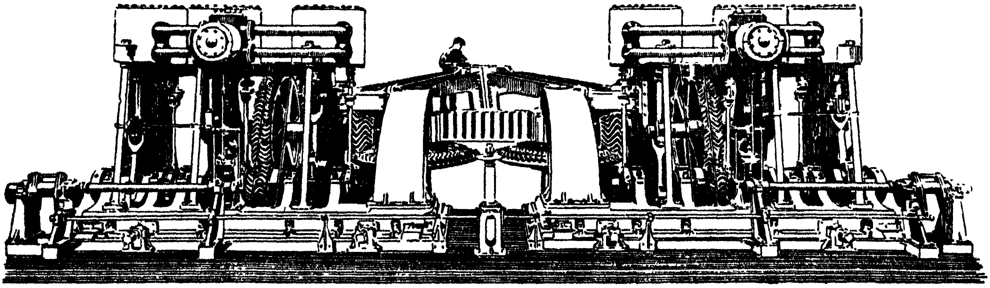
Ste'atite, a massive variety of talc. It is a compact stone, white, green of all shades, grey, brown, or marbled, is very soft, and is soapy or unctuous to the touch, hence the name *soapstone.* It is used in the manufacture of porcelain, in polishing marble, as a lubricant, and as the basis of rouge and other cosmetic powders. See *Talc.*

Steel is the term applied to certain qualities of iron containing carbon; but as the proportion of carbon can be graded continuously from wrought iron, which generally contains less than 0·2 per cent of carbon, up to cast iron, which may contain as much as 5 per cent, the position of steel lying between these is necessarily indefinite. (See *Iron.*) Besides the essential elements iron and carbon, steel also contains small quantities of silicon, phosphorus, manganese, and sulphur. In steel used for tools, springs, and various other purposes, long practically the only kind in use, and now known as *hard* or *tool* steel, the carbon varies in amount from about 0·8 to 1·3 per cent, the toughness, tenacity, and hardness being increased with the increase of the carbon, while the elasticity decreases with the increase of hardness. *Mild* or structural steel contains from 0·1 to 0·4 per cent of carbon. When it is red-hot, mild steel can be welded almost as easily as bar iron. It is a bright greyish-white in colour, the texture is granular, and in specific gravity it varies from 7·6 to 7·8. In commerce high-carbon steel takes various names: as when it is called *blister steel* from the character acquired by its surface in the process of cementation, *shear steel* when blister steel is doubled over and welded into bars, and *cast steel* when it is melted or cast into ingots. The value of hard or tool steel depends greatly on the readiness with which it can be hardened. It is found that the higher the temperature, within limits, to which it is raised and the more sudden the cooling the greater is the hardness. The hardness thus induced is always accompanied by a certain amount of brittleness, which is removed by an operation of tempering. This consists in reheating the hardened steel to a comparatively low temperature, followed by a second quenching. The temperature used is commonly judged by the appearance of temper colours on the steel, which are due to very thin films of oxide formed on the surface. The properties of steel are largely affected by the introduction of small quantities of other metals, such as nickel, chromium, manganese, tungsten, molybdenum, vanadium, &c.

The most important methods of producing steel are: (1) The *cementation process*, which consists in adding the requisite amount of carbon to wrought iron. The bars of iron are placed in fire-brick chambers between layers of charcoal and there subjected to heat from a furnace underneath. The fire is usually maintained for six or eight days, and the temperature to which it is raised depends upon the degree of carbonization required. When the bars, now become steel by the addition of carbon, are withdrawn, they are brittle and covered with blisters. (2) The *Bessemer process*. In this method, which was introduced by Bessemer in 1856, the carbon is first removed from the pig-iron by blowing a stream of compressed air through the metal when in a molten condition. When this is accomplished, the exact amount of carbon required is afterwards added in the form of *spiegeleisen*, or ferromanganese. Briefly, the process is conducted as follows. The charge of molten pig-iron is run from the furnace into the *converter*. This latter is a vessel formed of boiler plate, and lined internally with ‘ganister’. The converter is then swung back into a vertical position, and by this action the air-blast is automatically turned on. In a few minutes most of the silicon and manganese is removed, and the carbon is oxidized by the air to carbon dioxide and passes away with the blast. This having been shut off, a quantity of molten spiegeleisen is run in, and then the whole contents of the converter are poured out into the casting ladle. (3) The ‘*basic*’ or *Thomas-Gilchrist process* removes the phosphorus from such highly phosphoric pig-irons as those produced in the Cleveland district. To effect this the ordinary Bessemer converter is lined with a mixture of magnesia and lime, a quantity of the latter being also added to the charge when the blast is in progress. This lining enables basic slags to be maintained which combine with the phosphorus pentoxide produced by the oxidation of the phosphorus, thus forming metallic phosphates. The phosphates thus obtained are known as *basic slag*, and form a valuable fertilizer. (4) In the *Siemens-Martin* or *open-hearth process*, pig-iron is decarbonized by melting it with scrap iron, along with ores containing oxides of iron. First the pig-iron and scrap is charged into a furnace heated to a very high temperature by gas from a Siemens gas-producer. Then iron oxide is added in small quantities until the decarbonization of the pig-iron is complete. When this is accomplished, a fresh quantity of pig-iron is added to supply the exact amount of carbon required, or else the metal is recarburized by the addition of spiegeleisen, or ferromanganese. The whole charge is kept molten until ready to be run off into ingot moulds. (5) In the *Siemens process*, as recently modified, a much larger relative quantity of pig-iron is employed, and this in the molten state is run into a small amount of molten iron contained on the bed and previously completely decarburized. Iron containing phosphorus can also be used in a Siemens furnace, provided a basic bed is used and a basic slag provided for. (6) Electric furnaces have recently been largely used in the manufacture of high-class carbon steel and the special or alloy steels mentioned above. In some cases the electric furnace is used for purifying steels made by one of the other processes, as owing to the higher temperatures available, very basic slags may be formed which enable the sulphur to be removed. As a result of the improved methods of manufacture the cost of steel has been greatly reduced, and it has displaced wrought iron for many purposes, especially in the building of ships, while new uses for it have been found. For bibliography, see article *Iron*.

Steel-bow, a term in Scots law, *steel-bow goods* consisting in corn, cattle, straw, implements, &c., delivered by the landlord to his tenant, by means of which the tenant is enabled to carry on the farm, and in consideration of which he becomes bound to return articles equal in quantity and quality at the expiration of the lease. The origin of the term is uncertain.

Steele, Sir Richard, English essayist, was born in 1672, and died in 1729. At the age of twelve he went to the Charterhouse, where he first met his great friend and collaborator Addison. He entered Christ Church, Oxford, in 1689, afterwards migrating to Merton. His friend Addison was at this time a demy of Magdalen. Steele left Oxford abruptly without a degree in 1694, and enlisted as a trooper in the Horse Guards. His poem on the death of Queen Mary gained him an ensigncy in the Coldstream Guards. In 1700 he fought a duel with a Captain Kelly, whom he wounded severely. This misadventure inspired Steele to write a religious pamphlet, *The Christian Hero* (1701). This publication did not make Steele a favourite in his mess, and to rehabilitate his character as a wit he wrote a comedy, *The Funeral: or, Grief à la Mode* (1701). His other plays were: *The Lying Lover* (1703), *The Tender Husband* (1705), and *The Conscious Lovers* (1722). After an unsuccessful search for the philosopher's stone, he took to journalism as providing a more certain means of livelihood. *The Tatler* appeared on 12th April, 1709, and continued to appear thrice weekly until 2nd Jan., 1711. Addison joined Steele in this venture; and in Steele's own words " I fared like a distressed prince, who calls in a powerful neighbour to his aid; I was undone by my auxiliary; when I had once called him in, I could not subsist without dependence on him." Of the two hundred and seventy-one numbers of *The Tatler*, Steele wrote one hundred and eighty-eight and Addison only forty-one. The more celebrated *Spectator* appeared daily from 1st March, 1711, to 6th Dec., 1712. Of its five hundred and fifty-five numbers, Steele wrote two hundred and thirty-six and Addison two hundred and seventy-four. *The Spectator* was followed by *The Guardian* (1713), *The Englishman* (1713), *The Lover* (1714), *The Reader* (1714), and the less known *Town Talk*, *Tea Table*, *Chit Chat*, *Plebeian*, and *Theatre*. Steele, as a sturdy Whig, prospered after the accession of the Hanoverian dynasty. He became a justice of the peace and Deputy-Lieutenant of Middlesex, and was knighted in 1715. Steele was always in monetary difficulties, though he was twice married (1705 and 1707) and received a small fortune with both his wives. His second wife died in 1718, and Addison, with whom he had had a painful quarrel, died in 1719, so his later years were sad and lonely ones.



Steering Gear. Reproduced by permission of Messrs. The Citroën Gear Co., Ltd.

Steele and Addison were ideally matched as literary partners. Each was the exact complement of the other; it was ' the very marriage of pro with con '. Steele was a spontaneous and erratic genius, Addison was a cold and calculating man of talent. Steele was more original than Addison, and Addison more effective than Steele. Criticism has done scant justice to Steele by emphasizing the difference between his preaching and his practice. In many ways Steele was a greater man than Addison; he was more modest, more warm-hearted, and more human. He ranks as one of the earliest, wisest, and wittiest of English essayists.—Bɪʙʟɪᴏɢʀᴀᴘʜʏ: Austin Dobson, *Richard Steele* (English Worthies Series); G. A. Aitken, *Life of Richard Steele*; J. Forster, *Historical and Biographical Essays* (vol. ii); W. Hazlitt, *Lectures on the English Comic Writers*.

Steelyard, formerly a factory in London belonging to the Hanse merchants, who had long valuable trading privileges, and a certain measure of self-government, the internal discipline of their factory being half monastic and half military. Their factory was walled, and to this the Hanse merchants more than once owed their safety in popular risings, when Flemings and other foreigners were massacred. After the decline of the Hanse Towns (q.v.) the Steelyard remained in the possession of the free towns of Lübeck, Hamburg, and Bremen till 1853, when it was sold to some private speculators.

Steeplechase, a kind of horse-race across a difficult tract of country in which ditches, hedges, fences, and other obstacles have to be jumped as they come in the way. It is said that the name is derived from the fact that originally any conspicuous object, such as a church-steeple, was chosen as a goal, towards which those taking part in the race were allowed to take any course they chose. The steeplechase course of the present day is marked out by flags, between which the rider must pass before he can win the race. See *Horse-racing*.

Steering Gear. The course of a vessel is changed by altering the angle that the rudder makes with the longitudinal axis of the ship. In simple small boats a tiller serves the purpose of changing the setting, but with large vessels the loads encountered are very considerable, and some type of gear is essential. The motion from the steering wheel is given to a chain which is wound on to a drum at one end and off the other. This motion is taken directly to a tiller of the simple type, or to one of quadrant form, or to a steering engine, the motion of which is used to provide the actual travel. Suitable stops for the rudder must be provided on deck and securely fastened in the way of the tiller or quadrant to withstand the pressures. When brakes are fitted to the gear, or when the quadrant is directly geared to the steering engine, stops are unnecessary. Steamers of over 250 feet length are fitted with two independent steering gears, one of which is operated by steam or some form of mechanical gearing, the controlling wheels for which are mounted, the one beside the gear and the other on the navigating bridge.

Steevens, George, Shakespearean critic, born at Stepney in 1736, died in 1800. He was educated at King's College, Cambridge, and in 1766 he published *Twenty of the Plays of Shakespeare* in 4 vols. After this he was associated with Dr. Johnson in an edition of Shakespeare published in 1773. He then prepared a corrected text of the dramatist's works in 15 vols., which remained for a long time the standard edition.

Stein (stīn), Heinrich Friedrich Karl, Baron von, German statesman, born at Nassau 1757, died 1831. He studied at Göttingen, entered the mining department of the Prussian Government, became head of the mines and manufactures (1784) department in Westphalia, visited the mining districts of England in 1786, became president of the provincial chambers of Westphalia in 1796, and a Minister of State in 1804. For his criticisms on the administration he was dismissed (1807), but in a few months he was recalled, with power to introduce his reforms. Accordingly he abolished serfage by edict, made military service obligatory on all classes, and rearranged the financial and administrative affairs. In less than a year he was proscribed by Napoleon and dismissed from office, but his civil reforms, combined with the military reorganization of Scharnhorst and Gneisenau, formed the foundation upon which was raised the structure of Prussian greatness. He afterwards visited St. Petersburg (Petrograd), and was instrumental in bringing about the coalition which crushed Napoleon. When the military struggle was over, he spent his life in retirement. —Cf. Sir John Seeley, *Life and Times of Stein.*

Steinbock (stīn′bok), or **Steenbok** (stān′bok; *Nanotrăgus campestris*), a small antelope found in South Africa. It is ashen grey on the sides, white underneath, stands about 2 feet in height, and its flesh is much esteemed. The male alone has short horns. The name is also applied in Europe to the ibex (q.v.).

Steiner, Jakob, Swiss geometer, born 1796, died 1863. He is one of the most eminent of pure geometers, but had no taste for analysis. The co-operation of Steiner and the gifted young Norwegian mathematician N. H. Abel (1802–29) enabled A. L. Crelle in 1826 to found *Crelle's Journal*, a mathematical periodical with a long and distinguished history. A new chair of geometry was founded for Steiner at Berlin in 1834.

Stele, in botany, the central core of vascular or conducting tissue in the stem and root of vascular plants (Pteridophytes and seed-plants), also termed the *central cylinder.* Often, but not invariably, its outer boundary is clearly marked by the sheathing layer known as the *endodermis* (q.v.). There are many different types of stele, especially among Pteridophytes, and a great deal of ingenuity has been expended in classifying and explaining these. A recent theory which regards the type of stele as closely related to the size of the stem or root appears to have much in its favour.

Stellar Photography. Though the extensive use of photography in astronomy is comparatively recent, the association of the two sciences goes back a considerable time. Sir John Herschel in 1819 introduced the use of hyposulphite of sodium, and suggested the employment of glass plates. Daguerre's introduction of sodium iodide and a copper or sodium plate was brought into notice by Arago. Draper photographed the moon in 1840 with a wet plate, and five years later Fizeau and Foucault took a daguerreotype of the sun. Afterwards lunar photography was taken up by De la Rue and by Rutherfurd. More recently splendid photographs of the moon have been obtained at Paris by MM. Henry, and in the United States at Cambridge, Lick, and Mount Wilson (see Plate, vol. xi). The striking success of Gill in photographing the comet of 1882 inaugurated the era of astronomical photography. In the multiplicity and accuracy of detail permanently recorded with comparative ease and extraordinary rapidity, it has proved invaluable. For many years photographs of the sun have been taken at Greenwich on every day when weather has permitted. In connection with spectroscopy, photography is especially useful. By photography comets have been picked up at distances beyond visual observation. Faint minor planets and satellites have been discovered and their motions determined, though they may never have been directly seen. Photographs are also of particular advantage in showing which stars are nearest to us, by their displacements relatively to the more distant stars, on plates exposed at intervals of a few months. The parallaxes and distances are thereby found. One of the most important applications is in the cataloguing of the stars. As a result of an international conference in 1887, eighteen of the principal observatories took up the construction through photography of an *Astrographic Catalogue*, an enormous work, which will prove of the greatest service to astronomers in the future.

The relative times required by different stars to impress their images on photographic plates, or the comparative sizes of image given by a definite time of exposure, give a measure of the relative brightness of the stars. Stellar magnitudes so ascertained differ, however, from those estimated by the eye, in respect of stars of different colours, because the rays of the violet end of the spectrum are highly active photographically, and those of the red end extremely inert. Thus stars are spoken of as having certain photographic magnitudes, which may differ from the visual magnitudes. In each case a star is considered to be brighter than another by one magnitude when its light, photographic or visual, is 2·512 times brighter. (This number is the fifth root of 100.) The scales are so chosen that for any star of type Ao (a bluish star) the photographic and visual magnitudes are equal. For most stars the photographic magnitude is thus represented by a larger number than the visual. The difference is called the colour-index, and indicates the colour and, generally speaking, the spectral class of the star.

Stellenbosch, a town of Cape Province, Union of South Africa, connected by rail with Cape Town. Pop. 3000.

The name is associated in military slang with the curtailment of the powers of incompetent officers who, during the Kaffir wars, were relegated to this place: e.g. Kipling uses the phrase " You're bound to be Stellenboschеd ", in which the word is given the meaning of supersession without formal disgrace. Some writers, however, trace the word back to Lady Barnard (*South African Journal*, 1797), who described Stellenbosch as an asylum for old age.

Stem, in botany, the axis of growth of a plant above ground. The stem may be either herbaceous or woody, solid or hollow, jointed or unjointed, branched or simple, upright or trailing, &c. In some plants the stem is so short as to seem to be wanting, the leaves and flower-stalks appearing to spring from the top of the root. There are also stems, such as the rhizome and tuber, which, being subterranean, have been mistaken for roots. See *Botany*.

Stencil, a thin plate of metal, leather, or other material used in painting, marking, &c. The pattern is cut through the material composing the stencil, which is applied to the surface to be painted. The brush then being brought over the stencil, only the interstices representing the pattern receive the colours.

Stendal, a town and railway junction of Prussia, in the province of Saxony, on the Uchte. It has an old cathedral, and manufactures cloth, agricultural machinery, starch, leather, railway rolling-stock, and tobacco. Pop. 27,000.

Stendal is a junction on the line from Oberhausen to Berlin, via Hamm, Hanover, Wustermark, and Spandau, where it is met by the north and south line between Wittenberg and Halle (via Magdeburg). Another line runs north-west to Ülzen.

Stennis, or **Stenness**, a loch in Pomona, Orkney, a few miles north-east of Stromness, 14 miles in circumference. It is remarkable for the two groups of standing stones, somewhat similar to those of Stonehenge, which are found on its shores. The smaller group, of which only two remain erect, belongs to an area 100 feet in diameter with an outside ditch 50 feet in width. The larger group, known as the Ring of Brogar, consists now of fifteen stones in an enclosure 340 feet in diameter. See *Standing Stones*.

Stentor, a genus of infusoria popularly known as trumpet animalcules. They are among the largest of their kind, and are usually found adhering to the stems and leaves of aquatic plants.

Stephano'tis, a genus of plants of the order Asclepiadaceæ. *S. floribunda*, sometimes called *wax-flower*, is a favourite in cultivation. It is a climbing plant, with bunches of fragrant, white, waxy flowers, a native of Madagascar.

Stephen, Sir James, British historian, born in London in 1789, died in 1859. He was educated at Cambridge, practised as a barrister, became Under-Secretary (1834) for the Colonies, and on his retiral he was appointed professor of modern history in Cambridge University. He was the author of *Essays in Ecclesiastical Biography* (1849) and *Lectures on the History of France* (1851).

Stephen, Sir James Fitzjames, British judge, son of the preceding, was born in 1829, died in 1894. Educated at Trinity College, Cambridge, he was called to the Bar in 1854, became recorder of Newark-on-Trent (1859), legal adviser to the Indian Council (1869), professor of common law at the Inns of Court (1875), and a judge of the High Court of Justice (1879). He was the author of *Essays of a Barrister* (1862), *General View of the Criminal Law of England* (1863), *A Digest of the Law of Evidence* (1876), *A Digest of the Criminal Law* (1877), and *A History of the Criminal Law of England* (1883).

Stephen, Sir Leslie, British man of letters, born 1832, died 1904. He was educated at Eton, King's College, London, and at Trinity Hall, Cambridge. He was editor of the *Cornhill Magazine* from 1871 to 1882, when he undertook the editing of the *Dictionary of National Biography*. He resigned his editorial connection with the undertaking in 1891, when he was succeeded by Sidney Lee. His works include: *Hours in a Library* (1874–9), *History of English Thought in the Eighteenth Century* (1876), *Samuel Johnson* (1878), *Alexander Pope* (1880), *Swift* (1882), *An Agnostic's Apology* (1893), and *The English Utilitarians* (1900).

Stephen, St. There are three saints of this name in the calendar, viz.: (1) The martyr whose death is recorded in the *Acts of the Apostles*, chaps. vi and vii, and whose festival is held on 26th December; (2) Stephen, a Pope from 253 to 257 (his day is the 2nd August); and (3) Stephen the king (Stephen I of Hungary), a popular saint in Hungary and South Germany.

Stephen of Blois, King of England, son of Stephen, Count of Blois, and Adela, daughter of William the Conqueror, was born about 1097, died 1154. He was educated in England by his uncle, Henry I, and, on Henry's death in 1135, he claimed the Crown, in opposition to his cousin, the Empress Matilda, Henry's daughter. His success in seizing the throne was due to the support of the Church, and while he continued to enjoy clerical support he was able to defeat the invasion of David I of Scotland, who in 1138 fought the battle of the Standard (q.v.) as the champion of his niece, Matilda. But in 1139 Stephen quarrelled with the bishops, and in the same year the empress landed in England, and there began the period of civil war known as the Anarchy. Stephen was captured at Lincoln in Feb., 1141, and Matilda's party seemed to be triumphant, but in June the Londoners drove her out of the capital, and her half-brother and chief supporter, Robert of Gloucester, was soon after captured, and exchanged for Stephen. The crisis of the war came in 1142, when Matilda was besieged in the castle of Oxford, from which she escaped, at Christmas, across the frozen Thames. She continued the struggle until 1148, but never again seriously threatened the power of Stephen, who was able, in 1149, to defeat an invasion by Matilda's son, Henry. In 1153 Henry made a second invasion, and Stephen, who had lost his own heir, Eustace, made the Treaty of Wallingford by which Henry was to succeed to the Crown. His own mild temperament, and the civil war, prevented Stephen from giving England the stern rule which she needed, and the people, who suffered from baronial tyranny, looked back with horror to his reign, and welcomed the strong government of his successor, Henry II.

Stephens, or **Steph′anus** (English and Latin forms of *Estienne* or *Étienne*), the name of a notable French family of printers and scholars, the founder of which was Henry Stephens, who established himself in Paris about 1502. He was succeeded by his second son Robert (1503–59), who printed and published an edition of the New Testament (1523), a Latin Bible in folio (1528), and a *Thesaurus Linguæ Latinæ* (1532), and in 1539 was appointed king's printer. Of the whole Bible he printed some eleven editions. He in turn was succeeded by his eldest son Henry (1528–98), who visited Italy, Flanders, and England, and was instructed in all the learning of the time. In 1551 he joined his father, who subsequently had settled in Geneva, and published an enormous amount of work, among which were some fragments of Greek historians, *Apologie pour Hérodote* (1566), a great *Thesaurus Linguæ Græcæ* (1572), Plutarch (1572), and Plato (1573).

Stephenson (stē′vn-sun), George, British engineer, born at Wylam, near Newcastle, in 1781, died in 1848. In his fourteenth year he became assistant to his father, who was fireman at a colliery, and in 1812 he was appointed to manage the engine at Killingworth Colliery. Meanwhile he had been educating himself, chiefly in the science of mechanics, with the result that he obtained permission from Lord Ravensworth to construct a travelling engine for the colliery tramway. This he accomplished in 1814, and next year he introduced a great improvement in the shape of the steam-blast. In 1822 he succeeded in inducing the projectors of the Stockton and Darlington Railway to adopt an improved locomotive. He was then employed to construct the Liverpool and Manchester Railway, the directors of which accepted his locomotive called the *Rocket*, which at the trial trip in 1830 ran 29 miles in an hour. He was afterwards identified with numerous railway undertakings, and he was also the inventor of a miners' safety-lamp.—Cf. S. Smiles, *The Lives of George and Robert Stephenson*.

Stephenson, Robert, British engineer, son of the preceding, born in 1803, died 1859. He was educated at Newcastle, apprenticed to a coal-viewer at Killingworth, and attended science classes at Edinburgh University. Afterwards he assisted his father in the survey of various railway lines; and was subsequently employed in railway undertakings both at home and abroad. His most notable engineering achievements were the construction of the high-level bridge at Newcastle-on-Tyne, the railway bridge at Berwick-on-Tweed, the tubular bridge over the Menai Straits, and the Victoria tubular bridge over the St. Lawrence in Canada.

Stepniak, pseudonym of Sergei Mikhailovitsh Kravtshinsky, Russian revolutionary writer, born in 1852, died in 1895. Whilst a student in St Petersburg he joined a nihilist circle, was arrested in 1874, but escaped. He subsequently lived in Italy and in Switzerland, where he was active in spreading revolutionary propaganda, and in 1884 settled in London. His works include:

Underground Russia, The Russian Storm Cloud, and *King Stork and King Log.*

Steppes, a Russian name applied to those extensive plains which, with the occasional occurrence of low ranges of hills, stretch from the Dnieper across the south-east of European Russia, round the shores of the Caspian and Aral Seas, between the Altai and Ural chains, and occupy a considerable part of Siberia. In spring they are covered with verdure, but for most of the year they are dry and barren.

Sterculia'ceæ, a natural order of polypetalous dicotyledons, allied to Malvaceæ. The plants of this order are trees or shrubs, with alternate, stipulate, simple, and often toothed leaves, with a variable inflorescence. They are natives of tropical and subtropical regions. The most important member of the order is the cacao tree; others are the kola tree, the baobab, the durian, and the silk-cotton tree. Of these, baobab and silk-cotton belong to the sub-order Bombaceæ (or Bombacaceæ), which is often classified as a separate order.

Stereochemistry. In its broadest sense, this term is applied to the study of all that concerns the arrangement in space of the atom in the molecule; but in the more restricted sense, it is the study of substances which show a particular kind of isomerism dependent on the arrangement of the atoms in space. The atoms are regarded as being grouped around a central atom in such a way that there is no plane of symmetry. For instance, certain carbon compounds in the liquid state or in solution rotate a ray of plane polarized light either to the right or to the left, e.g. *lactic acid* prepared by the souring of milk has no effect on polarized light, whereas *sarcolactic acid*, of the same molecular formula and same chemical properties, rotates polarized light to the right. These substances are represented by the formula $CH_3CHOH{\cdot}COOH$, and the only difference appears to lie in the arrangement of the atoms in space around the second of the carbon atoms mentioned in the formula. Ordinary lactic acid may be broken up into two forms, one rotating polarized light to the right, *d-lactic* acid, the same as sarcolactic acid; and one rotating polarized light to the left, *l-lactic* acid. These two acids are *stereoisomers.* The foundations of stereochemistry were laid by the chemists van't Hoff, Le Bel, and Pasteur. At first stereochemistry was confined to carbon compounds and to those compounds which affected polarized light. For instance, stereoisomerism explained the four different tartaric acids, the two fumaric acids, &c. Later, the phenomenon was more widely studied, and it was found that many elements, both nonmetals such as nitrogen, sulphur, phosphorus, silicon, &c., and metals such as cobalt, chromium, &c., exhibit the same phenomenon of stereoisomerism in certain of their compounds, and exist in different forms with the same chemical characteristics, but different melting-points and other physical properties.

Stereoscope, an optical instrument based on the principle of binocular vision. If two photographs of a landscape are taken from two slightly different lateral positions, and the photographs are mounted side by side and looked at through a stereoscope, a single picture is seen which has the appearance of solidity or relief. The usual form of stereoscope is that in which the two images are combined by means of lenses. Stereoscopic lenses are formed from two segments of a convex lens placed with their thin edges towards each other. The rays from corresponding points in the two pictures are refracted by such lenses towards their thickest parts, i.e. to the sides of the stereoscope, and thus appear to the eye to diverge from a single point where the composite image is formed. A partition is placed so that each eye sees only one picture. The double photographs required for the stereoscope can be taken by means of the stereoscopic camera.

Stereum, a large genus of basidiomycetous Fungi, family Thelephoraceæ. The fruit-bodies resemble small shelf-fungi (Polyporineæ), but bear the basidia on the surface instead of in tubes. *S. hirsutum* is very common as a saprophyte on rotting wood, but can act as a parasite on deciduous trees, the spores gaining access through wounds.

Sterlet, a ganoid fish of the Caspian and various rivers in Russia, the *Acipenser ruthēnus*, a species of sturgeon, highly esteemed for its flavour, and from whose roe is made the finest caviare. See *Sturgeon.*

Sterling, John, Scottish poet and essayist, born at Kames Castle, Island of Bute, in 1806, died 1844. He was the son of Edward Sterling, subsequently editor of *The Times*; received his education at Glasgow and Cambridge Universities; became for a short time editor of the *Athenæum*; took orders in the Church, and was ordained (1834) curate to Julius Hare at Hurstmonceaux; afterwards went abroad for his health, and published a volume of poems (1839), as also the tragedy of *Strafford* (1843). He is now known chiefly as the subject of Carlyle's *Life of John Sterling* (1851), which was inspired by the inadequacy of the memoir prefixed by Archdeacon Hare to Sterling's *Essays and Tales* (1848).

Sternberg, a town of Czecho-Slovakia, in Moravia. It has important manufactures of linen, cotton, hosiery, tobacco, and liqueurs. Pop. 14,600.

Sterne, Laurence, English humorist, was born in 1713, and died in 1768. His father was an impecunious army officer, who never rose above the rank of lieutenant. Sterne accordingly spent his childhood and part of his boyhood in one barracks after another in different parts of Ireland and England. At last he was sent to school at Halifax, and, after his father's death, to Jesus College, Cambridge. His great-grandfather (died 1683) had been master of this college, and subsequently Archbishop of York. Sterne graduated B.A. in 1736, and M.A. in 1740; he was ordained deacon in 1736, and in 1738 was presented to the living of Sutton-in-the-Forest, near York, being ordained priest in the same year. He lived at Sutton for twenty years, and his life was uneventful, save for his marriage to Elizabeth Lumley in 1741, and the birth of his daughter Lydia in 1747.

In 1759 Sterne suddenly leapt into fame by publishing two volumes of *The Life and Opinions of Tristram Shandy.* The dates of the different volumes of this masterpiece are as follows: vols. i and ii, 1759; vols. iii, iv, v, and vi, 1761–2; vols. vii and viii, 1765; and vol. ix (the last) in 1767. Sterne, therefore, was forty-six years of age before he attained celebrity. He was lionized in London, and had social engagements ‘ a fortnight deep ’. On the strength of his success he published a collection of his sermons in seven volumes. One of his new friends, Lord Fauconberg, presented him to the perpetual curacy of Coxwold. His health, however, began to fail, and he travelled in France from Feb., 1762, to the summer of 1764. In the autumn and winter of 1765 he went for a tour on the Continent, which supplied him with material for his *Sentimental Journey through France and Italy* (2 vols., 1768). Soon after the appearance of this work Sterne died in his London lodgings.

To appreciate Sterne's wayward genius in a few words is difficult. The learned Dr. Farmer, master of Emmanuel College, Cambridge, warned those *in statu pupillari* who admired *Tristram Shandy* that " however much it may be talked about at present, in the course of twenty years, should any one wish to refer to it, he will be obliged to go to an antiquary ". This was an extremely erroneous prophecy. *Tristram Shandy* is, however, read in spite of its eccentricities, not because of them. Its peculiarities are many. Its author said himself, " If I thought you was able to form the least judgment or probable conjecture to yourself, of what was to come in the next page—I would tear it out of my book." He also said with much truth, " I think there is a fatality in it—I seldom go to the place I set out for." Owing either to his innate character or to his sojourn in Ireland, Sterne considered that laws were made to be broken. He asserted the liberty of the novel, and some critics have passed on him the verdict of Rabbi Busy, " Thou art all licence, even licentiousness itself." It was his pathos and sentiment which chiefly recommended him to his contemporaries. Dowden has well said of him, " Mr. Yorick made a mistake about his family tree; he came not out of the play of *Hamlet*, but out of *As You Like It.* In Arden he wept and moralized over the wounded deer; and at Nampont his tears and sentiment gushed forth for the dead donkey." In his singular combination of humour and pathos, and in his lack of self-control, Sterne indeed resembles Jaques. His great virtue lies in his style, which Hazlitt called " the pure essence of English conversational style ", and in his characters, especially Walter Shandy, Corporal Trim, and Uncle Toby, the last of whom the same critic called " one of the finest compliments ever paid to human nature ". Sterne is a paradox; the most pathetic of humorists, affected in his simplicity, and original in his plagiarisms.—BIBLIOGRAPHY: J. Ferriar, *Illustrations of Sterne*; H. D. Traill, *Sterne* (English Men of Letters Series); W. Sichel, *Sterne: a Study*; L. Melville, *The Life and Letters of Laurence Sterne*; P. Fitzgerald, *Life of Sterne.* A most unsatisfactory criticism of Sterne will be found in Thackeray's *English Humorists.*

Sternhold, Thomas, one of the writers of the first metrical version of the *Psalms.* Born about 1500, he was educated at Oxford, became groom of the robes to Henry VIII, and died in 1549. The principal coadjutor of Sternhold in this work was John Hopkins.

Sternum, in anatomy, the name of the breast-bone of vertebrate animals. In man the sternum forms the front boundary of the thorax or chest in the middle line, and to it the first seven pairs of ribs are attached. It consists in the adult of three pieces, named the *manubrium,* the *gladiolus,* and the *ensiform cartilage* or *xiphoid* appendage. It has a concave surface posteriorly, gradually decreases in breadth from above downwards, and averages about 6 inches in length. See *Thorax.*

Stesichorus (ste-sik′o-rus), Greek lyric poet, was born about 640 B.C., and died about 555 B.C. Little is known of his life that is not legendary, and only a few fragments of his poems are extant. His name was originally Tisias, but was changed to Stesichorus (chorus-driller) on account of his profession. He was a native of Himera, in Sicily, but possibly a Locrian by descent. He introduced an important innovation into the form of the choral ode by adding the epode to the strophe and antistrophe; the three movements became known as the Triad of Stesichorus. The most famous legend about him is that he was struck blind for misrepresenting Helen in one of his poems; but he received back his sight after writing a palinode in which he stated that not

Helen but her phantom had been carried off to Troy. It is difficult to estimate the value of the poetry of Stesichorus from the scanty fragments extant; but such as they are they bear out the criticism of Quintilian, who said that Stesichorus sustained the burden of epic poetry with his lyre.

Steth′oscope, an instrument used in medical practice for conducting the sounds in the thorax and other cavities of the body. There are two types, the single and the binaural. The single, or older, form is less frequently used now, and consists of a hollow cylinder, usually of wood, one end of which is funnel-shaped and the other a comparatively large circular plate. When in use, the funnel-shaped extremity is placed on the surface of the body and the ear of the listener on the circular plate. The binaural stethoscope is the form most widely used, and consists of a chest-piece usually of vulcanite, to which are attached two pieces of rubber tubing. These are usually from 18 to 24 inches in length, and lead to a framework on which there are two ear-fittings for insertion in the ears of the listener. See *Auscultation.*

Stettin′, a town and seaport of Germany, capital of the province of Pomerania, on the Oder. The principal part is built on the left bank of the river, while on the right bank are the suburbs of Lastadie and Silberwiese, connection being maintained by several bridges, one of which is a large railway swing-bridge. The town has greatly expanded since the removal of the extensive fortifications by which it was surrounded. Industries, which are numerous and important, include iron-founding, shipbuilding (Vulkan and other yards), machine-making, the manufacture of chemicals, cement, sugar, &c. It has been a port of some importance since the twelfth century, and, after being in Swedish hands, fell to Prussia in 1720. Pop. (1919), 232,726.

Stettin is an important railway centre through which passes the line from Berlin (83 miles), via Eberswalde and Angermünde, that runs via Stargard, Belgard, Köslin, Stolp, and Boschpol to Danzig (230 miles from Stettin). Another line runs westwards to Pasewalk Junction. See *Prussia, East* (section on *Communications*); *Systems, Railway.*

Steubenville, a city of Ohio, United States, the county seat of Jefferson county, on Ohio River; served by the Pennsylvania, Wabash, and other railways. Iron and steel, glass, wood-pulp and paper, pottery, and tinplates are made; the adjacent area is rich in natural gas, bituminous coal, petroleum, &c. Settled in 1797, Steubenville became a city in 1851. Pop. 28,500.

Ste′vens, Alfred, English sculptor, metal-worker, and painter, born at Blandford, Dorsetshire, 1818, died in London 1875. He studied painting, architecture, and sculpture in Italy, being for some time a pupil of Thorwaldsen. On his return to England he painted portraits, designed metal-work for a Sheffield firm, and executed a number of decorative paintings. In 1856 his design for the monument to the Duke of Wellington in St. Paul's was accepted; and this remains his most important work, despite being unfinished at his death, owing to delays and postponements by the authorities. Another notable decorative scheme which he carried to completion is a room in Dorchester House, Park Lane. Among his oil-paintings *Mrs. Collman*, *Morris Moore*, and a *Self Portrait* (all in the Tate Gallery) are notable examples.

Stevens, Alfred, Belgian painter, born in Brussels in 1828, died in Paris in 1906. He received his art training at Brussels under Navez and at Paris under Ingres, but also came under the influence of Courbet, and soon attained great success as a painter of dainty interiors and portraits, typified by *The Lady in Pink*, *The Four Seasons* (in the palace at Brussels), *Ophelia*, *The Parisian Sphinx*, *The Japanese Mask*, and *The Lady Bird.*

Stevenson, Robert Louis, British novelist, essayist, poet, and traveller, was born in 1850, and died in 1894. He was christened Robert Lewis Balfour, but at the age of about eighteen he dropped the use of 'Balfour' and changed the spelling though not the pronunciation of 'Lewis'. His grandfather was Robert Stevenson (1772–1850), engineer to the Scottish lighthouse board, who designed and constructed no fewer then twenty lighthouses, including the famous Bell Rock tower. His father, Thomas Stevenson (1818–87), was also a celebrated engineer, as were his uncles Alan (1807–65) and David (1815–86). Robert Louis Stevenson was an only child, and from his earliest days was feeble and sickly. When eight years old, he almost died of gastric fever. He suffered from bronchial trouble, and was in addition very highly strung. His health interfered with his education to a great extent, but he attended Edinburgh Academy fitfully for some time, and went to several private schools, as well as having tutors. It is impossible here to give a detailed account of his juvenile travels, much less of those of his maturity. They were almost all undertaken in pursuit of health, which he never found. In 1867 he matriculated at Edinburgh, and attended engineering classes. It was taken for granted that he would enter the family profession, and he spent part of his summer vacations in superintending certain engineering works. His heart was not in this work, and it was too much for him physically, so in 1871 he began to read for the Bar, intending, however, to adopt literature as a profession. He was called to the Bar in 1875, but never practised. Meanwhile he was serving a strenuous appenticeship to literature. He had dictated a *History of Moses* at the age of six, and published a pamphlet on *The Pentland Rising of 1666* at the age of sixteen. He was an exacting self-critic, and destroyed many of his youthful productions. In 1878 his first book appeared, *An Inland Voyage*, an account of a canoe tour in Belgium and France; *Travels with a Donkey in the Cevennes* appeared in 1879. Stevenson began to contribute to various periodicals, such as the *Cornhill* and *Temple Bar*. Some of his contributions were subsequently published in book form as *Virginibus Puerisque* and *Familiar Studies of Men and Books*. *The New Arabian Nights*, a not entirely successful series of fantastic modern tales, appeared in *London*. In 1879 Stevenson travelled to California by emigrant ship and train, and was extremely ill. In spite of his bad health he managed to write several stories and essays, and to make the first draft of his fantastic tale *Prince Otto*. In 1880 he married Mrs. Osbourne (*née* Van de Grift). He returned to Europe in 1880, and was by way of living in Scotland, but wintered abroad. In 1884 he settled at Bournemouth. *Treasure Island* (originally known as *The Sea-Cook*) appeared as a serial in *Young Folks* in 1882. This glorious tale was the first of Stevenson's works to make him widely popular. Another boys' tale, *The Black Arrow* (1883), was unaccountably preferred by some critics (not by its author) to its predecessor. In 1885 he published *Prince Otto*, *A Child's Garden of Verses*, and *The Dynamiter*. In the next year his famous apologue, *The Strange Case of Dr. Jekyll and Mr. Hyde*, appeared, and increased his reputation immensely. The same year saw the publication of his great historical romance *Kidnapped*. In 1887 Stevenson's father died, and he left Europe for ever. In 1888 he set out on a South Sea voyage, stayed at Honolulu, visited the leper settlement at Molokai in 1889, and settled down finally at Vailima, Samoa. At Samoa he interfered frequently in local politics, and occupied an almost patriarchal position among the natives. He died very suddenly on 3rd Dec., 1894, having ruptured a blood-vessel in his brain. Among his later publications are: *The Wrong Box*, a farcical tale in which his stepson collaborated (1888); *The Master of Ballantrae*, a great historical romance, of which, however, the climax is something of an anti-climax (1889); *The Wrecker*, a modern novel in which his stepson collaborated (1892); *Across the Plains* (1892); *Island Nights Entertainments* (1893); *Catriona* (1893), a sequel to *Kidnapped*, which is a brilliant exception to the rule that sequels are invariably disappointing; it is, however, considerably less of a boys' book than its forerunner; and *The Ebb-Tide* (1894), in which his stepson collaborated. *St. Ives*, an unfinished romance of less distinction than his other tales, was published posthumously in 1897, the concluding chapters being written by Sir A. T. Quiller-Couch (q.v.). *Weir of Hermiston*, the greatest of his novels, and the one upon which he was working a few hours before his death, is a magnificent fragment, being only about a quarter of its intended length. Stevenson also wrote many poems (*Underwoods* and *Ballads*), several plays in collaboration with Henley (*Beau Austin*, *Admiral Guinea*, *Robert Macaire*), and innumerable letters; and left behind several incomplete romances (e.g. *Heathercat* and *The Young Chevalier*).

Stevenson lived too recently to allow criticism to assign him with unanimity his permanent place in English literature. There is no doubt that he owed some of his charm to the romance of his life and the fascination of his personality. His personality was indeed paradoxical; he was an altruistic egoist; a curious mixture of John Calvin and Robin Goodfellow; a hedonist with strict views about the whole duty of man. Another paradoxical fact about him was that his poems were less laboured than his prose; he wrote verse as a relaxation from the rigours of prose composition. The variety of his work is hardly less remarkable than its brilliant qualities; he wrote essays of all kinds, travels, romances, short tales, fables, biographies, dramas, and poems. Of him no less than of Goldsmith may it be said: " Nullum fere scribendi genus non tetigit; nullum quod tetigit non ornavit ". But chief among his works stand out his great romances: *Treasure Island*, *Kidnapped*, *Catriona*, *The Master of Ballantrae*, and the fragmentary *Weir of Hermiston*.—BIBLIOGRAPHY: Graham Balfour, *Life of Robert Louis Stevenson*; Sir Sidney Colvin, *Letters of Robert Louis Stevenson*; Sir Walter Raleigh, *Robert Louis Stevenson: an Essay*; L. C. Cornford, *R. L. Stevenson*; E. B. Simpson, *R. L. Stevenson's Edinburgh Days*; R. Masson, *Robert Louis Stevenson*.

Stevenston, a town of Ayrshire, Scotland, on the Firth of Clyde. There are collieries, &c., but the chief industries are connected with Nobel's explosives works. Pop. (1921), 13,200.

Steward of England, Lord High, was one of the ancient officers of State, the greatest under the Crown. A lord high steward is now made only for particular occasions, such as a coronation or the trial of a peer.

Steward of Scotland, The High, an ancient chief officer of the Crown of the highest dignity and trust. He had not only the administration of the Crown revenues, but the chief oversight of all the affairs of the household.

Steward of the Household, Lord, an officer of the English royal household, who is head of the court called the Board of Green Cloth, which has the supervision of the household expenses and accounts. He selects the officers and servants of the household, and he appoints the royal tradesmen.

Stewart, Arabella, English princess, born at Chatsworth in 1575, died 15th Sept., 1615. She was the only child of Charles Stewart, Earl of Lennox, brother of Lord Darnley, and was great granddaughter of Margaret Tudor, daughter of Henry VII; thus being in the line of succession to the English throne. On the death of Queen Elizabeth, an abortive conspiracy was formed for setting up Arabella Stewart in opposition to her cousin James. Her private marriage to William Seymour, grandson of the Earl of Hertford, alarmed the court, and she and her husband were placed in confinement. They both escaped, but the Lady Arabella was recaptured and placed in the Tower, where she remained a close prisoner until her death.

Stewart, Balfour, Scottish physicist, born at Edinburgh 1828, died 1887. He was educated at St. Andrews and Edinburgh, engaged in mercantile affairs, and went to Australia for several years; and on his return was appointed successively assistant to Professor Forbes in Edinburgh, director of Kew Observatory, and professor of physics in Owens College, Manchester. Among his numerous writings are: *An Elementary Treatise on Heat* (1866); *Lessons on Elementary Physics* (1870); *Conservation of Energy* (1873); *The Unseen Universe* (1875) and *The Paradoxical Philosophy* (1878), in conjunction with Professor Tait; and *Practical Physics* (1885), in conjunction with Professor Gee.

Stewart, Sir Donald, born 1824, died 1900. He was educated at Aberdeen University, entered the Bengal Staff Corps in 1840, took part in the suppression of the Indian Mutiny in 1857, and in the Abyssinian expedition of 1867–8. He commanded the Kandahar column in the Afghan campaign of 1878–80, and marched with the field force from Kandahar to Kabul, defeating the Afghans at Ahmed Kheyl. He was commander-in-chief in India (1881–5), and was made field-marshal in 1894.

Stewart, Dugald, Scottish philosopher, born 1753, died 1828. Educated at the University of Edinburgh, he succeeded his father as professor of mathematics at the university in 1785, but exchanged the mathematical chair for that of moral philosophy. So general and extensive was his acquaintance with almost every department of literature and science, and so readily did he arrange his ideas on any subject with a view to their communication to others, that his colleagues frequently availed themselves of his assistance in the instruction of their classes. As a philosopher Stewart belonged to the school of 'common sense', founded by Thomas Reid (q.v.), which aimed at establishing a series of fundamental truths indisputable as primitive facts of consciousness. His works include: *The Philosophy of the Human Mind, Outlines of Moral Philosophy, Philosophical Essays,* and *Dissertation on the Progress of Metaphysical and Ethical Philosophy.*

Stewart, James Francis Edward, Chevalier de St. George, Prince of Wales, known as 'the Old Pretender', was the only son of James II of England, and was born in London in June, 1688. In Dec., 1688, his mother took him to St. Germains, a fugitive from the victorious army of William of Orange, and here he remained, being proclaimed James III of England and VIII of Scotland on the death of his father in 1701. In 1708 he made an abortive attempt to land in Scotland, and he returned to France to distinguish himself on the fields of Malplaquet and Oudenarde. The '15, however, found him again in Scotland, and again a fugitive; but the Anglo-French alliance compelled him to leave France, and he retired to Rome, and subsequently to Madrid. He received a Papal pension, and married Maria Clementina (1702–35), the daughter of Prince James Sobieski of Poland. The Old Pretender died in 1766 without having greatly concerned himself with his son's (Charles Edward's) attempt to restore the Stewart dynasty in 1745.

Stewart, or Stuart (stū′ėrt), The Family of. This House derives its name from the important office of Steward of the royal household of Scotland. The name is occasionally written *Steuart.* The form of *Stuart* was first assumed when Queen Mary went to France, and was adopted by her descendants. The founder of the House was a Norman baron, *Alan,* whose second son, *Walter,* entered the service of David I of Scotland, and became *dapifer* or steward of the royal household. Walter (died 1246) obtained large grants of land (at Renfrew chiefly) from David. *Alexander,* the fourth steward, had two sons—*James,* who succeeded him in 1283, and *John,* known in history as the Sir John Stewart of Bonkyl, who was killed at Falkirk (22nd July, 1298). James was chosen as one of the regents on the death of Alexander III, and died (1309) in the service of Bruce. His son, *Walter,* the sixth steward, married Marjory, daughter of King Robert I, a union through which the Stewart family eventually succeeded to the Scottish crown. He died in 1326, and was succeeded by his son, *Robert,* the seventh steward, who, on the death of David II without issue, succeeded to the crown as Robert II (1371). For the subsequent history of the royal line, see the articles *Scotland*; *Robert II*; *Robert III*; *James I, II, III, IV, V*; *Mary Stuart*; *James I (of England)*; *Charles I* and *II*; *James II*; *William and Mary*; and *Anne.* Mary of Modena, second wife of James II of England, gave birth to James Francis Edward, Prince of Wales, commonly called the Old Pretender, or the Chevalier de St. George. In 1715 an unsuccessful attempt was made by the Jacobites, or Stewart party, to set this prince on the throne of his ancestors by force of arms. He married a granddaughter of John Sobieski, King of Poland, by whom he had two sons, Charles Edward, the Young Pretender (see *Charles Edward Stuart*), and Henry Benedict Maria Clement, who became a cardinal in 1747. A representative of the Stewart line directly descended from Henrietta Maria, daughter of Charles I (who was married to Philip, duc d'Orléans), survives in the son of Maria Theresa of the Modena family, Crown-Prince Rupprecht of Bavaria. Many noble families of Scotland are also descended from the Stewart line. — BIBLIOGRAPHY: S. Cowan, *The Royal House of Stuart from its Origin to the Accession of the House of Hanover* (2 vols.); M. Noble, *Historical Genealogy of the Royal House of Stuart.*

Stewart Island, the southernmost of the main New Zealand group, separated from South Island by Foveaux Strait. It is mountainous and afforested, and is a tourist resort. There are oyster-beds in the vicinity, and the sea-fishing is good. Area, 662 sq. miles; pop. 400.

Stewarton, a town of Ayrshire, Scotland, on Annick Water, 5 miles north of Kilmarnock. There is a large creamery, and textiles and dyed goods are produced. Cattle- and horse-markets are held. Pop. (1921), 3900.

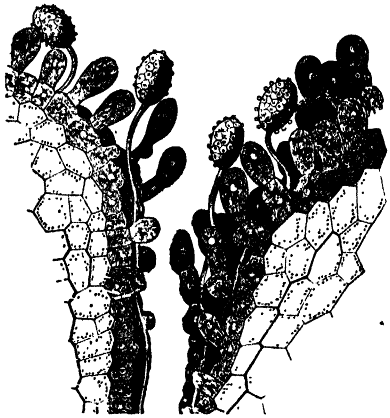
Stewartry, in Scotland, a territory formerly under the jurisdiction of a steward appointed by the king and having a position similar to a sheriff. The stewartry of Kirkcudbright, though bearing this distinctive name, is exactly in the same position as the other Scottish counties.

Steyr (stīr), a town of Upper Austria, at the confluence of the Steyr with the Enns, including within its bounds the suburbs of Steyrdorf and Ennsdorf. Iron and steel, cutlery, woollens, paper, and fire-arms are produced. Pop. 18,000.

Stibnite, trisulphide of antimony, Sb_2S_3, an ore containing 5 parts antimony to 2 parts sulphur. The colour is lead-grey or blackish, and it is very brittle and easily fusible. This ore is the source of most of the antimony of commerce. Called also *Antimony-glance* and *Antimonite.*

Stickleback, the popular name for certain small teleostean fishes which constitute the genus Gastrosteus and other allied forms. The species are found in the ponds and streams of Great Britain, as well as in salt water; they are very active and voracious, and live upon aquatic insects and worms. The sticklebacks are among the very few fishes which build muff-shaped nests for their young. The nest is composed of straw, sticks, &c., cemented together by sticky threads secreted by the kidneys of the male. In this the eggs, yellow in colour and about the size of poppy seeds, are deposited. The newly hatched young are jealously guarded by the male. The most common species is the three-spined stickleback, banstickle, or tittlebat (*G. aculeātus*), which is distinguished by the body being protected at the sides with shield-like plates, and by the possession of three spines on the back. It varies from 2 to 3 inches in length. Very similar is the two-spined stickleback (*G. pungitius*). The larger fifteen-spined stickleback (*Spinachia vulgaris*) is marine.

Stigma, in botany, that part of the carpel or gynœcium which serves for the reception of the pollen. Its surface is covered with knobs or papillæ, and with a sticky secretion which catches the pollen and also causes it to germinate.



Vertical Section through part of Stigma of Turk's Cap Lily, showing Papillæ, germinating Pollen-grains and Pollen-tubes passing down into the Style.

Stig'mata, marks said to have been supernaturally impressed upon the bodies of certain persons in imitation of the five wounds on the crucified body of Christ (cf. *Gal.* vi, 17). St. Francis of Assisi is said to have been supernaturally marked in this way, and a similar distinction was claimed for St. Catherine of Siena. In 1919–20 Father Pio of Foggia was said to bear these marks. It is possible that the few well-authenticated cases of stigmata which were not due to imposture were due to auto-suggestion.

Stil'bite, a mineral of the zeolite series, of a shining pearly lustre, of a white colour, or grey, yellow, or red. It is a hydrous aluminium calcium silicate, with some sodium, and is common in the cavities of basalt.

Stilicho (stil'i-kō), Flavius, Roman soldier, was probably the son of a Vandal captain of the barbarian auxiliaries of the Emperor Valens. His prowess and military skill made him invaluable to the Emperor Theodosius. That emperor having bequeathed the Empire of the East to his son Arcadius, and that of the West to his second son Honorius, the former was left under the care of Rufinus, and the latter under the guardianship of Stilicho. At the death of the emperor (in A.D. 394), Rufinus stirred up an invasion of the Goths in order to procure the sole dominion, which Stilicho put down, and effected the destruction of his rival. After suppressing a revolt in Africa, he marched against Alaric (A.D. 403), whom he signally defeated at Pollentia, but whose claim for a subsidy from the Roman treasury he afterwards warmly supported. This conduct excited suspicion of his treachery on the part of Honorius, who massacred all the friends of Stilicho during his absence. He received intelligence of this fact at the camp of Bologna, whence he fled to Ravenna. There, however, he was seized and put to death (A.D. 408).—Cf. T. Hodgkin, *Italy and her Invaders.*

Still, the apparatus used in distilling. Its invention is generally ascribed to the Arabs. It was known to alchemists of the eleventh century, and it is on record that stills were in use in Italy during the fourteenth century for the production of brandy commercially. It is supposed that stills for the production of whisky existed in Scotland during the eleventh century, probably in the monasteries, but it was not until the sixteenth century that they came into general use in Britain.

Stills are used in the manufacture of many substances (see *Distilling*), but perhaps most generally for the production of alcohol, either for use as a beverage or for industrial purposes. Of the potable alcohols the best known is whisky, and the stills used in its manufacture are of two kinds—*pot stills* for the finer and more expensive malt varieties, and *patent stills* for grain whisky. In a pot still the *body* is a large round vessel, generally made of copper, holding from 1000 to 5000 gallons, with a furnace below. From the top of the body rises the *head*, the diameter of which at its base may be one-third of that of the body. The head tapers upwards for 10 feet or so, when it bends over and contracts into a tube called the *worm*. This is formed into coils and led through a cooling-chamber or condenser, generally a vat of cold running water, and ends in a vessel called the *spirit receiver*. In operation the body is filled to about two-thirds of its capacity with *wash*, a fermented mixture of malt and water, and the furnace is lighted. When a certain temperature is reached, the more volatile constituents of the wash are converted into vapour and pass over, reappearing at the end of the worm in the shape of a liquid called *foreshot*. This is not whisky, and is directed into a separate receptacle. As the temperature in the body reaches the boiling-point of alcohol, true whisky distils over and is run into the spirit receiver. When the alcohol in the body is exhausted, the liquid issuing from the worm turns milky and is called *feints*; this is likewise diverted into a different receiver, and the operation is finished.

In the simple pot still described, all the essential oils and ethers present in the raw material are retained in the finished article, and it is therefore the most satisfactory means yet found for producing the finest qualities of whisky and brandy. It is, however, a slow and expensive method, and the strength of the spirit produced is comparatively low. In the early days spirit of high strength could only be obtained by repeated distillations. Adam of Montpelier, in the beginning of the nineteenth century, adapted the chemical apparatus known as 'Woulfe's bottles' for use with pot stills. This enabled practically pure spirit of the highest strength to be produced in one operation instead of, as hitherto, in several separate distillations, and revolutionized the wine-distilling industry in France. Stills of this type were extensively adopted in the West Indies for the production of rum. Although this system was a great improvement it possessed the drawback of being intermittent, the still requiring to be charged for each operation. Several makers in France succeeded in devising means for making the process continuous. Progress in this country was slower, being hampered by the excise laws, but Coffey invented an apparatus which admirably fulfilled all requirements, and stills of this type are now in universal use in Britain.

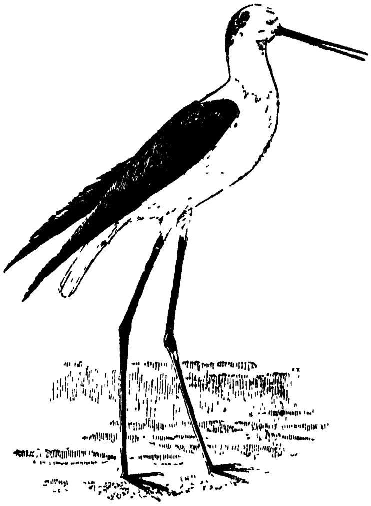
The *Coffey still* consists of two tall, square vertical columns filled with horizontal trays and tubes, arranged so as to let the wash, which is pumped in at the top, trickle slowly downwards, meeting in its passage steam admitted at the bottom which is pressing upwards. The spirit is thus extracted and at the same time purified. The operation is continuous, and the result is rectified or pure spirit of high strength. This type of still is used for the production of grain whisky, and also for industrial alcohol made from a variety of substances.—BIBLIOGRAPHY: W. T. Brannt, *Distillation and Rectification of Alcohol*; J. G. M'Intosh, *Industrial Alcohol*; C. Simmonds, *Alcohol: its Production, Properties, Chemistry, and Industrial Applications.*

Stillingfleet, Edward, English divine, born 1635, died 1699. He studied at St. John's College, Cambridge, and was successively appointed rector of Sutton in Bedfordshire (1657), St. Andrews, Holborn (1665), canon of St.

Paul's (1670), Archdeacon of London (1677), the following year Dean of St. Paul's, and Bishop of Worcester (1689). His writings, most of which are controversial, and combat the views of Roman Catholics, Nonconformists, &c., include: *Irenicum, a Weapon-salve for the Church's Wounds* (1659): *Origines Sacræ, or a Rational Account of the Christian Faith* (1662); *Rational Account of the Protestant Religion* (1664); *The Doctrines and Practices of the Church of Rome Truly Represented* (1686); and *A Vindication of the Doctrine of the Trinity* (1697).

Stillingia, a genus of plants, nat. ord. Euphorbiaceæ, one of the species being the famous tallow tree of China (*S. sebifera*). See *Tallow Tree.*

Stilt-bird, or **Stilt-plover**, a bird of the plover family, having remarkably long slender legs, a feature from which it derives its common name. The stilt-bird of Great Britain is the *Himantŏpus candidus* of naturalists. It has a long straight bill, large black wings, and the legs, which are of a red colour, measure from 18 to 20 inches.



Stilt-bird (*Himantŏpus candidus*)

Stimulants, in medicine, are drugs which increase the activity of any organ or function, but the term is popularly confined almost entirely to alcoholic stimulants. Alcohol is usually given in the form of *spirits*, especially *brandy* and *whisky*, which are given in acute inflammatory diseases, in septic conditions with fever, in chronic nervous diseases, neuralgias, and epilepsy. Among *wines*, *claret* or, less frequently, *port* is used as a tonic in cases of debility. *Champagne*, though much weaker than whisky, is one of the best stimulants. It is useful when whisky or brandy is not tolerated by the stomach. *Beer* and *porter* are nutritive, and are recommended in cases of wasting and loss of flesh. It is now generally held that the effectiveness of alcohol in the treatment of disease is due not to its stimulant properties, but to its narcotic effect, which produces a diminution of the anxiety and distress of the patient and an increase of rest and sleep. In cases of hæmorrhage, shock, and sudden depression of the heart, its value has been much questioned in recent years.

Sting, a sharp-pointed structure with which certain insects, bees and wasps in particular, are armed by nature for their defence. It consists of two slender blades sliding on a directing piece, and inflicts a wound into which poison is injected. The term is also applied to the last joint of a scorpion's tail. This ends in a sharp curved spine, near the end of which a poison-gland opens. Venomous serpents bite, but do not sting, as sometimes supposed. In this case the forked tongue has been mistaken for a sting.

Sting-ray, a fish belonging to the genus Trygon, family Trygonidæ, order Elasmobranchii, which is allied to that of the rays proper. It is remarkable for its long, flexible, whip-like tail, which is armed with a projecting bony spine, very sharp at the point, and furnished along both edges with sharp cutting teeth. Only one species (*T. pastināca*) occurs in the British seas, and is popularly known as the *fire-flaire.* It ranges from the North Sea through the Atlantic and Indian Oceans to Japan. Another species (*T. sabina*) lives in the rivers of Florida as well as in the sea. These fishes sometimes inflict serious wounds with their tail.

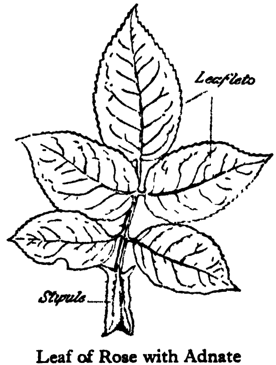
Stink-ball, a preparation of pitch, rosin, nitre, gunpowder, colophony, asafœtida, and other offensive and suffocating ingredients, placed in earthen jars, formerly used for throwing on to an enemy's decks at close quarters.

Stinkstone, a variety of limestone which gives off a fetid odour when quarried, due to escaping sulphuretted hydrogen.

Stinkwood, the timber of a species of laurel (*Ocotea* or *Oreodaphne bullāta*) found in Cape Colony and Natal, supplying excellent timber extensively used in wagon-building and also in furniture-making.

Stint (Tringa), a name applied to some of the sand-pipers. British species are the little stint (*T. minuta*) and Temminck's stint (*T. temmincki*).

Stip′ule, in botany, a small leaf-like appendage to a leaf, commonly situated at the base of the petiole in pairs, one on each side, and either adhering to it or standing separate. They are usually of a more delicate texture than the leaf, but vary in this respect as well as in form and colour. They are not found in all plants, but where they occur they frequently characterize a whole family, as in Leguminosæ, Rosaceæ, Malvaceæ, &c.



Leaf of Rose with Adnate Stipules

Stirling, James, Scottish mathematician, born 1692, died 1770. From Oxford he went to Venice, returning to London about 1725. In 1735 he became manager of a mining company in Lanarkshire. Next to Maclaurin and Newton himself, he was probably the most accomplished British mathematician of his time. His most important work is the *Methodus differentialis, sive tractatus de summatione et interpolatione serierum infinitarum. Stirling's Theorem* is a result much used in higher mathematics. It gives in a simple form the approximate value of the product of the first n natural numbers, when n is large, viz. $n! = \sqrt{2\pi n}(n/e)^n$.

Stirling, James Hutchison, Scottish philosopher, born in Glasgow in 1820, died in 1909. He was educated in arts and medicine in Glasgow University, France, and Germany; practised as a surgeon in Wales, but ultimately devoted himself to literary and philosophical studies. He is author of *The Secret of Hegel* (1865); *Sir Wm. Hamilton, being the Philosophy of Perception* (1865); *Jerrold, Tennyson, Macaulay, and other Essays* (1868); *As regards Protoplasm* (1869); *The Philosophy of Law* (1873); *Burns in Drama*, together with *Saved Leaves* (1878); *The Community of Property* (1885); *Philosophy and Theology* (the Gifford Lectures, 1890); and translator of Schwegler's *History of Philosophy*, and Kant's *Critique of Pure Reason* in his textbook to Kant.

Stirling, a royal and municipal burgh of Scotland, the county town of Stirlingshire, on the River Forth; an important railway junction. The town consists of an ancient portion formed of steep winding streets, and a modern portion built on the lower ground. The most important building is the castle, on the summit of an isolated intrusion of basalt (220 feet altitude). It has frequently been compared to the Acropolis at Athens. The principal parts of it as they now stand are the royal palace (rebuilt after a fire in 1855); the Parliament House, once a noble fabric, but now converted into army messrooms and other accommodations; the chapel-royal, now used as storerooms; and another palace begun by James IV, and finished by his granddaughter Mary. The castle stands across the natural road from the Highlands to the Lowlands, and all the traffic of every age between north and south has of necessity passed under its walls. For centuries it guarded the only bridge across the Forth, and is now maintained as a strong place in accordance with the Treaty of Union. A gigantic statue of Robert Bruce (erected 1877) and the old bridge reminiscent of the victory of Wallace over Edward I (1297) are notable objects. The principal manufactures are woollens, carpets, leather, ropes, and agricultural implements. Stirling was chartered as a burgh by Alexander II (1226), but is mentioned as a burgh in the time of David I. Pop. 21,300.

Stirlingshire, a midland county of Scotland, is bounded by the counties of Perth, Clackmannan, Linlithgow, Lanark, and Dumbarton. It has an area of 451 sq. miles. The valley of the Forth, along the northern boundary, and the eastern part of the county are rich agriculturally; the middle portion is largely occupied by the Campsie and other hills, while a projection extends northwards and includes Ben Lomond and parts of Loch Lomond and Loch Katrine. The chief river is the Forth; other streams are the Avon, Allan, Bannock, Blane, Carron, and Endrick. The coal-fields of the south-east are extensive; ironstone, fire-clay, and oil-shale are found, and limestone is wrought in the Campsie district. There are important manufactures of woollen and iron goods, chemicals, machinery, &c. (Falkirk being the chief industrial centre); breweries and distilleries, and at Grangemouth there are extensive docks. Pop. (1921), 161,726.

Stirrup, a strap or something similar hanging from a saddle, and having at its lower end a suitable appliance for receiving the foot of the rider, used to assist persons in mounting a horse, and to enable them to sit steadily in riding. Ancient writers make no mention of stirrups, and they are first known to have been used in Europe in the sixth century A.D. They were in use among the Anglo-Saxons, and by the twelfth century they were common.

Stitchwort, a popular name of several species of plants of the genus Stellaria. See *Starwort.*

Stock, a name originally applied to a cruciferous garden plant, *Matthiŏla incāna* (called more fully *stock-gillyflower*), but now extended to the various species of Matthiŏla, and to certain allied plants of the same order. They are herbaceous or shrubby, biennial or sometimes perennial, and have single or double fragrant flowers. *M. incāna* is probably the parent of the greater number of the hoary-leaved varieties cultivated in Britain, and known as Brompton stock, queen stock, &c. *M. annua* is the source of the common or ten weeks stocks, and *M. græca* of the smooth-leaved annual stocks. The Virginia stock (*Malcolmia maritima*) has been introduced from the Mediterranean, and, like the species already mentioned, is a great favourite in the flower-garden on account of its beauty and fragrance.

Stock-breeding and Feeding, the breeding and rearing of stock suitable for the production of flesh (fattening animals), milk (dairy and breeding animals), and power (horses). Success in stock-raising lies in the intelligent application of the laws of breeding. The breeder must have a definite type of animal in view, and particular care should be taken with the selection of the male, since his influence is most strongly felt. He should always be pure bred and of desirable pedigree (see *Heredity*).

Breeding of to-day comprises two main divisions: (1) pure-bred animals, (2) commercial animals. In the first type the principles of heredity are applied to one particular breed, efforts being concentrated upon the improvement of that breed by selection, and pedigrees, registered with appropriate breed-societies, are generally kept. The second type aims at blending the desirable features of one breed with those of another, and the improvement of animals of mixed breeds by the influence of more prepotent and desirable pure-bred sires. The mating of two discrete breeds produces a *cross*; an animal of mixed breeding is a *grade*. Grades are uncommon in Great Britain. The production of crosses is common with cattle, sheep, and pigs destined for meat, less so with dairy cattle, and uncommon in horse-breeding, especially of the heavy varieties.

	Horses.		Cattle.		Sheep.		Pigs.	
	Mare.	Stallion.	Cow.	Bull.	Ewe.	Ram.	Sow.	Boar.
Average period of gestation . .	340 days	—	283 days	—	150 days	—	172 days	—
Age usually first mated	3 years	2 to 3 years	1¾ to 2 years	1¼ years	1½ years	1 year	8 months	8 months
Age at which mature	6 years	6 years	6 years	5 years	4 years	4 years	3 years	3 years
Proportion of females to males	70	1	50	1	50	1	10	1

Rearing methods vary as the class. Those described are the general British practices which also prevail in the more densely populated parts of the world.

Cattle-rearing.—During the summer months of the period of gestation the cow can depend on pasture alone; in winter she must receive enough food to maintain her in condition. Theoretical requirements can be fulfilled by feeding 30 lb. turnips, 12 lb. oat-straw, 5 lb. hay, and 3 lb. concentrates. There are two alternative methods of rearing the calf. (1) The natural method of suckling, when a reasonably good milker will rear two calves simultaneously. If these be weaned when three months old, the cow will rear three others during her lactation period (nine months). (2) The calf may be separated from the cow at birth and taught to drink milk from a pail, while the cow herself is milked. The amount of milk fed (twice or thrice daily) is gradually increased to 1½ gall. Where the calf is weaned when four or five months old, separated milk and a fat substitute are generally substituted for whole milk. Until turned out to pasture in June, if over a month old, the calf should receive hay. On weaning, it progresses favourably on 1½ lb. of a mixture of crushed oats and linseed-cake. When taken indoors at night (September), its ration should gradually be increased till in winter, when only out for a few hours, about 16 lb. turnips, 8 lb. hay, and 2 lb. of oat-mixture are fed. A calf should never be allowed to lose flesh. In spring it is turned out to pasture (¾ acre is sufficient if good), and in October housed again. If for early slaughter it should receive a fattening ration, which, if present weight be 8 cwt, will ensure a weight of 10 to 11 cwt. after sixteen to eighteen weeks (a carcass weight 60 per cent of that amount). A suitable ration is 80 lb. turnips, 12 lb. straw, 4 lb. hay, and 6 lb. mixture of crushed oats and decorticated cotton-cake. If intended for dairy purposes or fattening during the following summer, 30 lb. turnips, 15 lb. straw, and 2 lb. oats and cake is sufficient. Such animals require 1 to 1½ acres good pasture in the next summer, and fattening animals should receive an additional 3 or 4 lb. cake per day when pasture becomes less bulky. Dairy animals, mated in the meanwhile, need no cake while at pasture. After calving they should be fed according to the milk-yield. In the byres a suitable ration is 40 lb. turnips, 12 lb. hay, and 6 lb. straw per 1000 lb. live-weight, with additional 3½ lb. concentrates per gallon of milk produced. A concentrate mixture of 2 parts decorticated cotton-cake, 3 parts bran, and 2 parts bean-meal is suitable. When turned out on an allowance of 1½ acres good pasture, no additional food is required, except in the case of heavy milkers, till grazing becomes poor. Then cake or cabbage may be fed. As winter approaches, cattle are kept longer indoors, till finally they are only turned out for exercise. An average dairy cow should produce 600 to 700 gall. milk and one calf annually. Terms applied to cattle include: *stirk*, *yearling*, one-year-old animal; *six-quarter old*, one and a half years old; *quey* or *heifer*, a female animal which has not yet produced a calf; *eild*, female animal which is now pregnant; *steer*, *stot*, or *bullock*, emasculated male; *slink calf*, newly born calf; *store cattle*, animals in lean condition suitable for fattening. See *Cattle*.

Horse-rearing.—For at least two months prior to foaling the mare should not be used for carting on rough roads. She may do ordinary cultivation work, however, and her ration should be modified to include frequent bran mashes. Late spring and early summer are the favourite periods for foaling. The mare, if not at grass, should be kept in a loose-box. On parturition the foal's umbilical cord is washed with antiseptic and bound up, and it should be seen that it is getting milk. The dam and offspring should be exercised daily, and when possible should be turned out to pasture. An allowance of 1½ acres will support them during the summer. When five or six months old, the foal is weaned and the mare returned to work. During the winter the foal should be kept in a loose-box, turned out for exercise daily, and given, e.g., 3 lb. of a mixture of crushed oats and linseed-cake, 8 lb. hay, and a few turnips. It should also be taught to be led by a halter. Emasculation takes place in the spring, after which it is turned out to pasture. It may be allowed to remain outdoors during the next winter, but the ration of the previous winter should be increased by about half. After grazing the following summer it may be trained to work during the winter, i.e. at two and a half years. The feet should receive attention from an early age, and, if necessary, light shoes (plates) may be fixed. When first broken-in to work, colts must be treated quietly yet masterfully, and the amount of work allotted is very gradually increased. Work horses must be liberally fed at regular intervals, and not less than three times a day. A suitable winter ration for a horse of 1700 lb. live-weight is 14 lb. crushed oats, 2 lb. crushed maize, and 16 lb. hay. In summer a horse can be turned out to pasture, and if working should receive two-thirds of the above amount of corn. Horses must receive as much water as they care to drink, and be groomed and well bedded when indoors.

Sheep-rearing comprises two main practices. (1) *Hill and Lowland.* (*a*) The season's breeding flock is established at the beginning of October by the sale of ewes over five years and the purchase of stock rams. The rams are put out to the hill with the ewes about mid-November, and are withdrawn about 1st January. Lambing then commences about mid-April, when the shepherd is practically continually on the hill. Ewes which lose their lambs are usually persuaded to adopt one of twins borne by other ewes, the ideal in this system being to rear one lamb per ewe. About the middle of June the rams, hoggs, and eild ewes are shorn, the tails of the lambs cut short, male lambs castrated, and all of the lambs cut in the ear (marked) for identification purposes. The ewes are shorn a month later, and the whole flock carefully herded against the ravages of the sheep maggot-fly. In August the lambs are weaned, and the castrated males (wethers) are sold. In September the cast ewes are sold, and at the beginning of October the ewe lambs are sent off to better pasture for the winter. Hill sheep get no food other than herbage. Government orders enact certain periods for dipping. (*b*) The lowland practice differs in the following respects: larger, more quickly maturing sheep are kept; lambing begins in March; during winter the ewes are given extra feeding, usual allowances being 8 lb. cut turnips per head per day till lambing commences, when they receive 1½ to 2 lb. mixture of oats, dried grains, and decorticated cotton-cake; if it is desired to sell the lambs fat, the ewes are given concentrates in addition to grass, and the lambs are also encouraged to eat these; the ewes are lambed in pens; shearing, tail-cutting, &c., are carried out earlier in the year. English lowland practice differs from Scottish in that lambing commences in January, and the cropping of the arable land is so arranged as to have the sheep continually folded on a special series of forage- and root-crops, such as oats, barley and vetches, crimson-clover, rape, kale, and turnips. Fat lambs are killed when from twelve to sixteen weeks old. (See *Sheep.*) The fattening period generally lasts twenty weeks. Each sheep should gain about 2 lb. per week, and on killing will give a carcass-weight of 50 per cent live-weight. A fat cross hogg of this age will weigh about 1 cwt. live-weight. Terms commonly applied in sheep-rearing include: *lamb*, young unweaned sheep; *hogg*, *hogget*, or *teg*, weaned sheep, not yet shorn for first time; *shearling*, ram after being once shorn; *gimmer*, ewe after being once shorn; *wether*, castrated male; *grit ewe*, ewe approaching lambing; *milled ewe*, ewe which has previously been mated with a ram of another breed; *cast ewe*, ewe drafted out of the breeding flock.—See *Pig*; *Sheep*; &c.—BIBLIOGRAPHY: *Standard Cyclopedia of Modern Agriculture*; W. A. Henry, *Feeds and Feeding*; J. Porter, *Stockfeeder's Companion*; P. M'Connell, *Agricultural Notebook*; O. Kellner, *The Scientific Feeding of Animals.*

Stock-dove (*Columba œnas*), a wild European pigeon about 13 inches in length, and with a general bluish-grey plumage, the breast being purplish. It raises two or three broods in a season, and builds its nest in a tree-stump or in a rabbit-burrow.

Stock Exchange. The beginnings of dealings in stocks in England go back to the latter part of the seventeenth century. The development of joint-stock enterprises in the eighteenth century, and especially the creation of a very large public debt, increased greatly the numbers of those dealing in stocks. For many years they traded mainly in the coffee-houses round Change Alley, but in 1801 the present Stock Exchange building was constructed in Capel Court, near the Bank of England, and the members formed themselves into a close corporation with a clearly defined and strictly maintained constitution. During the nineteenth century other stock exchanges arose in Liverpool, Manchester, Leeds, and other towns, all doing a considerable business, principally in local industrial securities.

Organization of London Stock Exchange.—The management of the business of the Stock Exchange is vested mainly in the hands of an annually elected committee of thirty subscribers, who administer the rules and regulations, and adjudicate in cases of dispute. All advertisement on the part of members of the house is forbidden. The members of the Stock Exchange are divided into brokers and jobbers. Brokers are, in effect, commission agents, who deal with the outside public and execute orders to buy or sell. Jobbers are dealers in securities who buy and sell shares on their own account, and it is to the jobber that the broker goes when he has an order to fulfil. The jobber will quote him two prices, the higher being the buying price and the lower the selling price; the difference between the two is termed 'the turn of the market', and constitutes the profit of the jobber. The jobber may not deal with the public direct, but only through the broker. As might be expected, the volume of transactions has led to a large amount of specialization, and many of the brokers and jobbers confine their attention to certain types of shares. Thus there is a Kaffir market dealing with South African gold, a rubber market, an oil market, &c. Broadly speaking, the whole of the regulations and methods of the Stock Exchange are designed, first, to secure the inviolability of contracts entered into, and secondly, to make it possible to do the largest amount of business in the shortest time.

Stock Exchange and the Banks.—In most cases the capital in the possession of the jobbers is not sufficient to enable them to take up large quantities of shares and hold them until there is an opportunity to resell at a profit. They rely, therefore, to a great extent on the banks, which provide advances on the security of the jobber's shares. Again, the banks lend money to the stockbrokers, with the aid of which the latter can prolong the speculative transactions of their clients. This operation takes place largely in the form of the *contango*. For example, the man who has bought shares, hoping that he will be able to sell them again at a profit, may arrange with his broker to carry the shares over one settlement day to the next, paying interest in the meantime at the *contango rate.* The broker uses the shares as *cover* to borrow from the bank the money necessary to hold them, for which he pays a lower rate than the contango rate he charges to his client. This method has enabled a large amount of speculation to be carried on by people who never intend to hold the shares, but only to buy for a rise in price or sell for a fall. The former class of operators, known as *bulls*, buy shares ahead at a given price, hoping to be able to sell them at the next settlement day at a higher price, and thus make a profit on the transaction. If the market has gone against them, they may *carry over* the transaction to the succeeding settlement day, merely paying the difference between the price at which they bought and the *carry-over price*, together with interest at the contango rate. The difference, plus the contango, thus paid by the bulls is received by the *bears*, who have sold for a fall. When the bears have to pay the carry-over interest, this is called *backwardation.* Not only members of the public but also many of the brokers speculate in this way. To facilitate these and other transactions, a special class of money brokers has arisen, who take an intermediate position between the bankers and the stockbrokers and jobbers. These are firms of considerable size which enjoy a specially good credit, and can at any time obtain large sums from the banks, which they lend again to the smaller brokers, &c. Their intimate knowledge of members of the house enables them to lend with less risk than an ordinary banker would incur, and therefore the existence of this class enables many to borrow to whom a bank would refuse the necessary accommodation. Without the intimate connections existing between the Stock Exchange and the banks, the placing and dealing in securities, both domestic and foreign, would be greatly hindered. It is this that enables London to provide a market for securities of practically every description, and makes possible dealings on a gigantic scale. At the same time, the banks find in the Stock Exchange a useful

water-ways and bridges is suggestive of Venice, and its picturesque islands have been made beautiful by many promenades and parks, the most beautiful of which is the Djurgården. It is besides a place of considerable trade, and has manufactures of woollen, linen, cotton, silk, porcelain, glass, tobacco, iron castings, &c. Pop. (1920), 419,429.

Stockport, a municipal and county borough of England, partly in Cheshire and partly in Lancashire, 5 miles south-east of Manchester, on the Mersey. It has a grammar-school founded in 1487. The cotton trade, connected with which are spinning, weaving, dyeing, &c., is the staple, and there are also foundries, machine-shops, breweries, and hat factories. Pop. (1921), 123,315.

Stocks, a wooden apparatus formerly used for punishment of certain offenders. It consisted of two pieces of timber or boards locked together, with holes to keep the ankles imprisoned. Petty offenders, vagabonds, and other minor criminals were placed in the stocks, usually on the village green, where they were laughed and jeered at by all passers-by. Whipping-posts were frequently attached to the stocks. Stocks were used in England in Anglo-Saxon times. They fell into disuse in the early part of the nineteenth century.

Stockton, a city of California, United States, the county seat of San Joaquin county, on the San Joaquin; served by the Central-Pacific and other systems. It is a wheat and general cereal and fruit trading centre, with manufactures of flour, soap, leather, and mining and agricultural implements. Settled in 1847, Stockton became a city in 1850. Pop. (1920), 40,000.

Stockton, or **Stockton-on-Tees**, a parliamentary and municipal borough and seaport of England, mainly in the county of Durham, on the Tees. Owing to its proximity to the Cleveland district, the town has ironworks, foundries, blast-furnaces, engineering-works, shipbuilding-yards, potteries, and bottle-works. The river admits vessels of some size. Stockton sends one member to Parliament, the parliamentary borough including South Stockton on the south bank of the Tees, in Yorkshire, incorporated as a municipal borough in 1892 under the name of Thornaby-on-Tees. The Stockton and Darlington Railway, the first passenger line in England, was opened in Sept., 1825. Pop. 64,150.

Stoicism, a system of philosophy which flourished first in Greece and subsequently in Rome, so called from *Stoa poikile*, the painted hall or colonnade in Athens, where the lectures of the Stoic philosophers were given. The system was founded by Zeno of Citium, born in 336 B.C. Originating and developing in Greece, stoicism seems to have been specially adapted to flourish in Rome, where it attracted the most vigorous and the most typical minds, so that Roman virtue became almost identified with stoicism, and pagan Rome and stoicism may be said to have expired together. Among the leading Stoics of Greece were, besides Zeno, Cleanthes, Chrysippus, Zeno of Tarsus, and Diogenes of Seleucia. Among the Romans stoicism was embraced by Cato of Utica, Cicero, and Brutus, and had among its expositors Cicero, Seneca, and Epictetus. In the later days of the Roman Empire stoicism modified itself greatly in the direction of conformity with the prevailing spirit of Christianity. Stoicism, which is a development of cynicism, is primarily practical in character, and the aim of the founder was ethical, that is, to teach virtue as the art of right living. In respect to the practical side of their philosophy, the Stoics may justly be regarded as being the followers of Socrates. Stoicism divides philosophy into the three departments of logic, physics, and ethics. Logic includes dialectic and rhetoric, physics cosmology and theology, and ethics politics. The logic of the Stoics is based on Aristotle. They make the mind a *tabula rasa*, and reason itself a sense. The representations of things are formed by the senses on the mind, but the latter, as it were, goes out from itself and grasps the object. In physics the Stoic doctrine was that everything real is material; besides matter there is nothing but abstractions which have no actual existence. Matter consists of two elements, a passive formless element, susceptible of motion and form; and an active moving and moulding element. Mind, intellect, or reason is represented by the active force of matter, which is immanent in the passive. God is the working force of the universe, and is described as an artistically creative fire. The view of the Stoics on the universe has been rightly called 'pantheistic materialism'. The ethics of the Stoics is the most important part of their system, and its fundamental principle is liberty. The end of morals is harmony with nature, nature of man and of the universe combined, i.e. living a life in accordance with the laws of nature, or in conformity to reason, which is the fundamental principle of human nature. The model of stoical morality is the wise man, who acquires his superiority by subduing his passions, which are the enemies of liberty. Virtue is sufficient for happiness. No act, however, is virtuous or vicious in itself, but only in its motive. Pleasure is a result of action, but not the end of it. The cardinal virtues are wisdom, courage, justice, and discretion. There are no degrees in virtue; it is absolute, and there is no mean between virtue and vice. Coming into contact *with Christianity*, stoicism was absorbed in the new religion in the first centuries of our era.—Bibliography: W. L. Davidson, *The Stoic Creed*: E. V. Arnold, *Roman Stoicism.*

Stoke-Newington, a northern metropolitan borough of the county of London. It contains Clissold Park and the New River, and Defoe Road, a feeder of Church Street and the Kingsland Road–Stoke-Newington Road trunk line of streets, commemorates Daniel Defoe, a quondam resident. Area, 863 acres; pop. 52,167.

Stoker, Mechanical, a device fitted to boiler furnaces to facilitate the regular firing of the fuel and to increase the combustion efficiency. Hand firing of boilers has many disadvantages besides the obvious one of entailing very heavy manual toil. Good stokers are very rare, and few of the men on such work really try to maintain efficient conditions for the combustion of the fuel they throw into the furnace. Unless the bed of coal is kept of uniform depth and a suitable air-supply is maintained above and below the fire-bars, the services of a hand-stoker may be very expensive in fuel and in fines for producing black smoke. The mechanical stokers are of two classes. In the first the two operations of driving off and burning the volatile gases and consuming the solid residue are carried out in different parts of the furnace. The second is usually an endless band on which the fuel is carried forward continuously, and the ash resulting is deposited at the back of the boiler. The combustion processes in this case are continuous. In some types a reciprocating motion is given to the fire-bars instead of the continuous travel.

Stokes, Sir George Gabriel, Bart., British mathematician and physicist, was born in Sligo in 1819, and died at Cambridge in 1903. In 1841 he was senior wrangler and first Smith's prizeman, and was elected to a fellowship at Pembroke College. In 1849 he became Lucasian professor of mathematics. He represented Cambridge University in Parliament from 1887 to 1892, was president of the Royal Society from 1885 to 1890, and was created a baronet in 1889.

Stokes was a prolific writer on nearly all branches of mathematical physics, but especially on the undulatory theory of light. The idea of determining the chemical constitution of the sun and the stars by means of their prismatic spectra originated with him, and was communicated by him to Lord Kelvin some years before Kirchhoff's formal publication of the discovery. A valuable report by Stokes on double refraction was published by the British Association in 1862. His discoveries in hydrodynamics occupy a considerable space in every modern account of the subject. In pure mathematics also Stokes did some notable work; his paper of 1847 on the critical values of the sums of periodic series contains almost the earliest reference to the very important modern idea of uniformity of convergence of infinite series. Stokes's collected mathematical and physical papers have been published in five volumes.

Stokes Gun. See *Trench Mortars.*

Stoke-upon-Trent, a county and municipal borough of Staffordshire, England, in 'the Potteries', on the Trent. It comprises (since 1910) Stoke proper, Burslem, Hanley, Fenton, Longton, and Tunstall, and has manufactures of pottery (the chief industry) and machinery. There are railway workshops. Pop. 240,450.

Stokhod, a river of Poland, tributary of the Pripet. It gives name to a battle fought between the Austro-Germanic and Russian armies in July, 1916, during the great Russian victory of the Styr (see *European War, Russian Campaign, 1916*).

Stola, a garment worn by the Roman women over the tunic. It came as low as the ankles or feet, was fastened round the body by a girdle, leaving broad folds above the breast, and had a flounce sewed to the bottom. It was the characteristic dress of the Roman matrons, as the toga was of the men.

Stolberg, a town of Rhenish Prussia, on the Vicht. It is a centre of coal-, iron-, lead-, and zinc-mining, and has smelting-plant, iron-foundries, rolling-mills, and glass- and chemical-works. Pop. 14,500.

Stole, a long narrow band or scarf with fringed ends, worn by ecclesiastics of the Roman and English Churches: by deacons over the left shoulder, being fastened under the right arm; by bishops round the neck, with both ends pendent in front to the knees; and by priests similarly, but with the ends crossed when wearing the alb.—*Groom of the stole*, the first lord o the bed-chamber in the household of the English kings. See *Alb.*

Stolp, a town of Pomerania, Prussia, on the Stolpe; a railway junction on the Belgard Danzig and Schneidemühl-Stolpmünde railways Stolpmünde, 12 miles distant, is the port. Stolp possesses an ancient castle. Railway repair-shop and manufactures of woollens, leather, tobacco machine-shop products, and linen are important In mediæval times Stolp was a member of th Hanseatic League. Pop. 33,800.

Stolypin, Peter Arcadevich, Russian statesman, born 1863, died 1911. Of noble birth an of great personal worth, Stolypin joined th Russian bureaucracy in 1884, and from th governorships of Grodno and Saratov and th Ministry of the Interior, he became Ministe (1906) in succession to Goremykin. His activ efforts for the conciliation of the more moderat elements in the Duma failed, largely on accou of his land reform schemes. Stolypin dreamed a Russia of loyal and contented peasant-owners, and defied the institutions evolved by centuries of tradition to solve the age-long agrarian question. He was also considered by the extremists as a reactionary whose vigorous measures drove the revolutionaries to despair, and his humiliating treatment of non-Russian nationals, and, in a degree, of the intelligentsia, inspired the enemies of the Tsar with the deepest hatred against his Minister. All attempts against him failed until 1911, when he was shot in a theatre at Kiev, under the eyes of the Imperial family, by a Jew named Mordka Bogrov, an agent of the secret police.

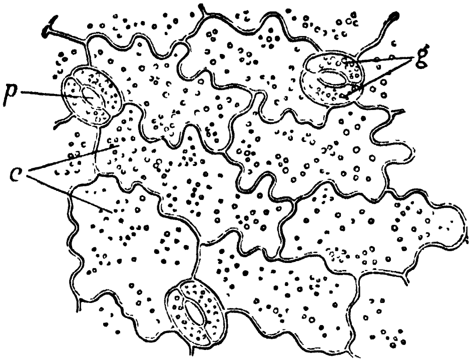
Stomach, the most dilated portion of the digestive (or alimentary) tube; it is situated in the upper part of the abdominal cavity. It extends from the lower end of the gullet (œsophagus) to the beginning of the small intestine, but its shape and position are much modified by the amount of food it contains, by the stage of digestion that has been reached, by the development of its muscular walls, and by the position of the other adjacent organs. The opening by which the gullet communicates with the stomach is known as the cardiac orifice, and is situated on the left side, while the pyloric orifice, which communicates with the small intestine, is on the right side of the abdomen at a lower level. Between these two openings the walls of the stomach form in front a broad border, known as the greater curvature, which varies with the amount of stomach content, and a narrow fixed border behind, the lesser curvature. The pyloric orifice is controlled by a valve, formed by a thickened portion of the circular muscular fibres, and the action of the valve is to prevent regurgitation of food from the intestine. The wall of the stomach is composed of various coats, and in these coats are situated the gastric glands, which secrete the gastric juice, an important factor in digestion. The main constituents of the gastric juice are hydrochloric acid, pepsin, and various salts, chiefly chlorides. The main function of the juice is to convert the proteins of the food into peptones, but it also curdles milk, inverts sugar, helps in the digestion of fats, and on account of the acid present is an antiseptic, and thus prevents putrefactive processes from ordinarily taking place in the stomach. It has been found that in carnivorous animals a higher percentage of each constituent of the gastric juice is present than in man, as there is more digestive work for the juice to perform. About twenty years ago much definite information on the action of the gastric juice, and the psychical influences that affect it, was obtained by the experimental work of the Russian physiologist, Pawlow.

The stomach, like other glandular organs, is subject to various diseases. Interference with proper digestion leads to dyspepsia of some form, and ulceration in the wall may take place, causing gastric, or peptic, ulcer, while the stomach is one of the common sites of cancer, either following a gastric ulcer or secondarily to cancer in one of the surrounding organs.

Stomach-pump. See *Toxicology.*

Stomach-staggers, a disease in horses, depending on a paralytic affection of the stomach. In this disease the animal dozes in the stable and rests his head in the manger; he then wakes up and falls to eating, which he continues to do till the stomach swells to an enormous extent, and the animal at last dies of apoplexy, or his stomach bursts.

Stomata, in botany, minute orifices or pores in the epidermis of leaves, &c., the chief external openings of the ventilating system of intercellular spaces (q.v.). Each stoma is enclosed by two sausage-shaped *guard-cells*, which by contracting and expanding regulate the size of the aperture. Transpiration of water-vapour and absorption of carbon dioxide take place mainly through the stomata.



Stomata from the Leaf of a Fern in Surface View

p, Pore. *gg*, Guard-cells. *e*, Epidermal cells.

Stomatop′oda, an order of crustaceans, having five pairs of foot-jaws and three pairs of small forked legs. The second pair of foot-jaws are large seizing organs, with a spiny end-joint bent back like the blade of a pocket-knife. See *Squilla.*

Stone, Frank, English genre painter, born at Manchester 1800, died at London 1859. He painted at first in water-colours, and was for long a member of the old Water-colour Society. In 1851 he was elected A.R.A. His first important work in oil, *The Legend of Montrose*, was exhibited at the Academy in 1840. Among his subsequent works are: *The First Appeal*, *The Last Appeal*, *Mated*, *The Course of True Love*, and *The Gardener's Daughter.* Most of his works have been engraved.

Stone, Marcus, British artist, son of the preceding, born in London in 1840, died in 1921. He learned his art in his father's studio; exhibited his first picture in 1858 in the Academy, of which he became an associate in 1877, being elected an Academician in 1887. Among his better-known pictures are: *Claudio accuses Hero* (1861), *On the Road from Waterloo to Paris* (1862), *Stealing the Keys* (1866), *Henry VIII and Anne Boleyn* (1870), *Sain et Sauf* (1875), *Il y en a toujours un autre* (1882), *A Gambler's Wife* (1885), and *The First Love Letter* (1889).

Stone, an urban district and market town of Staffordshire, England, on the Trent. It manufactures earthenware, beer, shoes, &c. Pop. (1921), 5600.

Stone Age. See *Archæology*; *Neolithic*; *Palæolithic Age.*

Stone, Building. A good building stone must be durable, that is, able to resist 'weathering' well. Durability is to some extent conditioned by climate and situation, but in the main it depends upon the chemical composition and the structure of the stone. In a wet climate, or in an atmosphere charged with excess of carbonic acid or with other gases given off from large manufacturing and industrial works, no stone will last as long as in a dry climate or in a purer atmosphere. A compact, non-porous, crystalline stone is the best for outside work. The presence of iron, at least in large quantity, is objectionable, because it readily oxidizes, thus producing decay and spoiling the appearance of the building. Stone used in building must be easily worked into the forms required. For some purposes hardness is an essential quality, but the hardest stones do not always resist weather best. The principal building stones are sandstones and limestones, with granites, slates, and serpentines as important secondary kinds. Sandstones are found of many colours, white, yellow, grey, brown, red, &c., the colour being determined by the form in which iron appears in the stone. Those kinds which do not readily divide into thin layers and are easily worked by the chisel are called freestones, a name also applied to similar limestones. Among notable varieties of limestone used in building are marble, in Britain confined to ornamental inside work; Portland stone, a granular limestone of which many leading buildings in London are constructed; dolomite or magnesian limestone, used in the Houses of Parliament; Bath and Caen stone, used for fine interior work. Granite is generally used in Britain only for ornamental parts of buildings, but in some places where it is abundant, notably Aberdeen, it is the main building material. The term granite as used by builders includes syenite and syenitic granite. Slate is the best roofing stone, but some thicker varieties, called slate slabs, are used for cisterns, sills, &c. Serpentine, sometimes misnamed marble, is used for ornamental interior work.

The preservation of stone from decay is an important question in large cities. Painting the stone with ordinary paint, oil, or paraffin does not protect it for long, and is apt to spoil its appearance. More useful processes consist in the formation of insoluble silicates on the surface of the stone, but efflorescence may result, with consequent disfigurement of the building. Kuhlmann's process consists in coating with a solution of silicate of potash or silicate of soda. In Ransome's process the stone is first saturated with a silicate of soda or potash, and a solution of calcium chloride then applied. The result is the formation of insoluble calcium silicate on the surface, thus giving greater hardness and durability to the stone. Other silicate paints have been used with more or less success.

Various kinds of *artificial stone* (other than brick and terra-cotta) have come into fairly extensive use in recent years. Ransome's artificial stone is prepared from dried sand, silicate of soda, and calcium chloride. The first two are intimately mixed with some powdered stone or chalk, and the mixture is forced into moulds. A cold solution of the chloride is poured over the blocks so formed, and they are next immersed in a boiling solution of the same substance. The finished stone is equal to the best natural building stone in weathering qualities, and is very easily worked. Victoria stone is made by mixing finely powdered granite with Portland cement, allowing the mixture to set into the required shape, and then immersing the block in silicate of soda. It is chiefly used for paving.

Stone, Building Construction in. The stone used for building is of varied composition but the two chief kinds are sandstones and limestones, though granites and other igneous rock are largely used in some districts. The layers o stratified rocks indicate the natural bed of the stone. All such stones, when used in ordinary walling, should be laid upon their natural bed having the edges of the layers exposed on the face of the wall. The many varieties of masonry may be grouped under two heads, namely, *ashla* and *rubble.* Ashlar masonry is built with block of stone carefully worked, so that the joints ar generally $\frac{3}{16}$ inch in thickness for at least inches from the face of the wall. All stone should be laid on a bed of lime or cement morta extending over the whole surface. The sid joints should be properly filled up, and in rubbl work they should be thoroughly packed wit spalls or shivers and mortar. The outer edg of the joint in ashlar masonry is often set i lime or oil putty $\frac{1}{4}$ inch in breadth, but some times Portland cement is used, and at othe times the joint is a little wider and the mortar is kept back from the face for ¼ inch in outside work and ¾ inch in internal work, for the sake of effect. Stones which stretch along the face of the wall and extend inwards only a short distance, say equal to the height of the stone, are called outbonds. Those stones which extend entirely or partly through the walls so as to bind the face and back together are called inbonds. The bond is of great importance in masonry. There should never be a continuous vertical joint either on the face or in the interior of the wall. It is not easy to define bond in masonry, because all stones are not of one size. Inbonds are generally stated to be not more than 5 feet apart in each course and to be placed in position first, the outbonds being fitted between them. The lap or bond which one stone has over the adjacent ones on the faces of the wall should be 5 or 6 inches at least, and preferably more. In rubble masonry the beds and joints are generally only roughly dressed. All stones should be laid on their widest beds. In squared rubble built in courses there should be no square stones in elevation, and at any vertical joint not more than three stones should meet. When squared rubble is not built in courses, the work is often called ‘ snecked ’ rubble. When rubble has hammer-dressed joints, these vary in thickness from about ⅛ to ⅜ inch or more, depending on the nature of the stone and the skill of the builder. Generally, rubble joints are about ⅜ inch in thickness. When a wall is not of the same kind of building from front to back, it is called a compound wall, and this is the ordinary way in which masonry is carried out, unless a wall is to be seen on both faces. Walls may be finished in ashlar on the front face, while their backs may be of rubble built in courses. For proper setting, and for the sake of appearance, corner stones (*quoins*), if they are not dressed on face, generally have a tooled or drafted margin worked round them. There are many ways of finishing the face of stones. For example, they may be polished, rock-faced, dabbed, pinched, broached, scabbled, or, as in the case of limestones, left with a combed surface. Copings and other more or less detached stones, such as balusters, are kept in place by dowels of gun-metal, bronze, slate, or hard stone, also by cramps of bronze or iron bent squarely down at the ends. The ends are made ragged to grip the lead, which is closely batted into position to prevent air or moisture gaining access to the metal.—BIBLIOGRAPHY: *Rivington's Notes on Building Construction*; C. Gourlay, *Elementary Building Construction for Scottish Students*; W. R. Purchase, *Masonry.*

Stone-chat (*Pratincola rubicŏla*), a perching bird of the thrush family. The stone-chat is common in Europe, and frequents moors and other open wastes. Its colour on the upper part generally is black, the belly is yellowish-white, and the breast a light chestnut brown. It runs with much celerity, and its food consists of insects and worms.

Stone Circles, ancient monuments of unknown origin and date. They consist of upright pillars (‘ monoliths ’) of unhewn stone set round a more or less circular area. They are very common in the British Islands, especially in Scotland. See *Standing Stones.*

Stone-fly, the common name of insects belonging to a family of neuroptera (Perlidæ), much used by anglers as a bait in trout-fishing. The hinder wings are large, the abdomen is furnished with two long appendages, and the larger jaws or mandibles are rudimentary. These flies and their larvæ occur plentifully in the neighbourhood of lakes and ponds.

Stonehaven, a police burgh, seaport, and seaside resort of Scotland, county town of Kincardineshire, on a bay at the mouths of the small rivers Carron and Cowie. It consists of an old town, and a new town on the left bank of the Carron. There is a large tanwork, and the herring and other fisheries are important. Pop. 4250.

Stonehenge′ (A.S. *stanhengist*, hanging stones), an extensive group of standing stones on Salisbury Plain, Wiltshire, England, about 7 miles north of Salisbury. They form two circles and two ovals. The outer circle, which is about 300 feet in circumference, consisted, when entire, of sixty stones, each being about 15 feet high and 7 feet broad. Of these, thirty were uprights, others were imposts, the uprights being placed at intervals of 3½ feet, and the imposts fitting by means of tenon and mortice. Of the outer circle twenty-four uprights remain (seventeen standing and seven down) and eight imposts, and at the grand entrance there are eleven uprights remaining, with five imposts. The inner circle, which is 8 feet from the outer, consisted of about thirty stones, 6 feet in height, without imposts; nineteen remain, eleven standing. The first oval consists of five trilithons, as they are called, that is, groups of three stones, two uprights, with an impost. Before each trilithon stood three smaller upright stones, but there are only six now standing. Inside the inner oval is a large slab supposed to have been an altar. The whole is surrounded by a double mound and ditch, and there is also an avenue leading from the north-east, bounded by a mound and ditch. In the surrounding plain are numerous tumuli. These circles may date from the Bronze Age; but nothing is known of their origin or date, and excavation has done little to dispel our ignorance. On 15th Sept., 1918, Stonehenge, bought from Sir Cosmo Antrobus, was presented to the nation by Sir Cecil Chubb, of Salisbury.—Cf. Sir J. N. Lockyer, *Stonehenge and other British Stone Monuments Astronomically Considered.*

Stonehouse, or **East Stonehouse,** a district of Devonshire, lying between Plymouth and Devonport. It has extensive barracks, the Royal Naval Hospital, and the Victualling Office. In 1914 it became part of Plymouth (q.v.).

Stone-plover, a large species of plover, the *Œdicnēmus Scolopax.* It appears in England at the latter end of April, frequents open hilly situations, makes no nest, but lays two eggs on the bare ground, and emigrates in small flocks about the end of September. Called also *stone-curlew* and *thick-knee.*

Stonesfield Slate, in geology, a fissile Middle Jurassic limestone occurring at Stonesfield, in Oxfordshire. It is noted as one of the few beds in which mammalian remains of Jurassic age have been preserved.

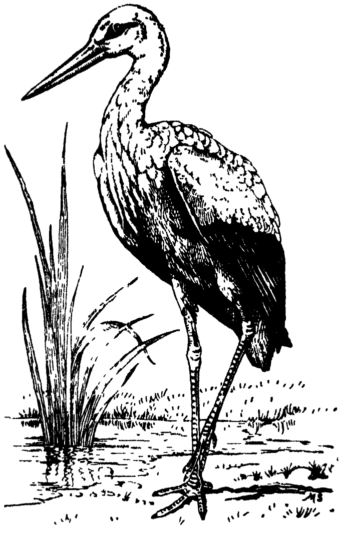
Sto′nyhurst College, an English Roman Catholic educational institution 10 miles north of Blackburn, Lancashire, conducted by Jesuit fathers. It has a good observatory and an excellent library, including some bibliographical rarities. There are about 300 students.

Stoppage in Transitu is the exercise of a right allowed by law to an unpaid seller to stop the delivery of goods purchased by a buyer who has become bankrupt while the goods are in the hands of a carrier or middle-man for transmission. Stoppage in transitu, as the term implies, can only take place while the goods are actually on the way, since if they have arrived at their journey's end the seller's right over them has ceased.

Storax, a resin which in former times was derived from *Styrax officinalis,* a small tree which grows in Asia Minor, and was much used for incense. It is probably the *stacte* mentioned in *Exodus,* xxx, 34. All the storax which occurs in commerce nowadays, however, is obtained from the trunk of *Liquidambar orientalis* (see *Liquidambar*). The storax is not a normal product of the tree, but is induced artificially by beating the bark. The purified balsam (*Styrax præparatus,* or prepared storax, or liquid storax) is a brownish-yellow, translucent, semi-liquid substance with a strong aromatic odour and taste. In its action it resembles Balsam of Peru. It is used as a parasiticide, especially in scabies, and as an expectorant.

The name storax is also sometimes given to a balsam from the American sweet gum (*L. styraciflua*), which is often substituted for genuine storax.

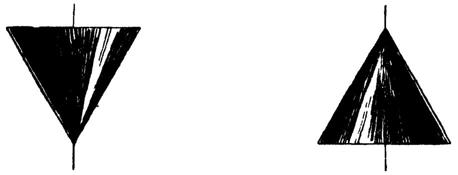
Stork, a name given to the birds of the family Ciconiidæ, of which the type-genus is Ciconia. They are tall and stately birds, the long beak being moderately cleft and destitute of a nasal furrow. The common stork (*C. alba*) is found throughout the greater part of Europe (being a very rare visitor to Britain), but passes the winter in Africa and Asia. The adult is pure white, with the exception of the black quill feathers of the wings, the scapularies, and greater wing-coverts, and the red beak, legs, and toes. It is about 3 feet 6 inches in length, and when erect its head is about 4 feet from the ground. It is remarkable for its affection towards its young. The black stork (*C. nigra*) occurs in Poland and Prussia, and in the sequestered parts of the Alps. *C. abdimii* is an African species Among other well-known storks are: adjutan (*Leptoptilus dubius*) of India; jabiru (Mycteria of America, Africa, and Australia.



Common Stork (*Ciconia alba*)

Storm-signals. The system of forecasts o the Meteorological Office had its beginning in th storm warnings inaugurated in 1861. These ar displayed at various ports and fishing-stations where a cone is hoisted point upwards if northerly gale is expected, and point downward for a southerly one. For the weather maps drawn daily at 1 a.m., 7 a.m., 1 p.m., and 6 p.m. information is obtained by telegraph, telephone or wireless from stations distributed over th British Isles, and from shipping on the Atlantic On these maps the several weather features ar represented in the notation introduced b Admiral Beaufort. Thus ' b ' denotes blue sky ' c ' cloudy, ' f ' fog, ' t ' thunder, ' z ' haze, &c the letters being entered in the appropriat positions. The directions of the wind are shown by arrows, having each a number of *flèches* proportioned to the local wind force on the Beaufort wind scale. This scale employs numbers from 0 to 12 to denote the different strengths, originally defined by the sail which a ship could carry. Thus '4' represents a moderate breeze, 13 to 18 miles per hour, in which all sail could be used; '8' a fresh gale, 39 to 46 miles, requiring considerable reduction of canvas; '11' a storm of from 64 to 75 miles, necessitating close-reefed sail running, or heaving to under storm sail; '12' a hurricane.

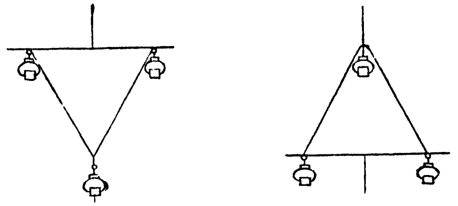
From Feb., 1920, hourly reports of meteorological information, given in a special code form, have been sent out from the wireless station at the Air Ministry, and forecasts similarly circulated eight times a day.



South Cone Day Signals North Cone

Gales from E., S.E., S.W., or W., veering to S.W., W., or N.W.

Gales from N. W., N., or N.E., veering to N.E. or E.; also gales from S.E., E., or N.E., backing to N.



Night Signals, Lights in Triangle

Stornoway, a police burgh and seaport of the Island of Lewis (Ross-shire), Scotland, about 180 miles from Oban. It is the centre of the fishing industry in the Outer Hebrides, its export of fish being chiefly to the Baltic ports. Pop. (1921), 4100.

Stothard (stō′thȧrd), Thomas, British artist, born in London 1755, died 1834. Having shown an aptitude for drawing, he was bound apprentice to a drawer of patterns for brocaded silks, and soon attempted book illustration in his leisure hours. He afterwards drew designs for the *Town and Country Magazine*, Bell's *British Poets*, and the *Novelist's Magazine*. He also became a student at the Royal Academy; exhibited a picture there in 1778; was elected an associate in 1791, and in 1794 an Academician. Among his works, which number over 5000 designs, the more important series and single designs are for Boydell's *Shakespeare*, illustrations of *Robinson Crusoe*, *The Pilgrim's Progress* (1788), *The Rape of the Lock* (1798), Cowper's *Poems* (1825), Rogers's *Italy* (1830), and *Poems* (1834); while his best-known works are: *The Canterbury Pilgrims*, *The Flitch of Bacon*, *Greek Vintage*, *Fête Champêtre*, *Sancho and the Duchess*, &c.

Stourbridge (stur′brij), a municipal borough and market town of Worcestershire, England. It has extensive manufactures of glass, iron, and fire-bricks. Pop. (1921), 18,000.

Stourbridge Clay, a celebrated fire-clay, with nearly 80 per cent of silica, found in a bed 4 feet thick in the coal-measures of Stourbridge, in Worcestershire.

Stove, a form of heating apparatus. The simplest type consists of a hollow iron vessel, closed at the top, and fitted at the bottom with bars on which the burning fuel rests. Air enters from beneath, and a pipe carries away the products of combustion. The stove is more efficient than an open fire, in which much of the heat escapes up the chimney. But a closed stove makes a room uncomfortably dry, for it acts mainly by convection, so that moisture is deposited from the warm air on the cooler walls and furniture. Moreover, the poisonous gas carbonic oxide is apt to escape from an iron stove. On the continent of Europe and in America the stove is much more commonly used than the open fire for domestic heating. Continental stoves are frequently made of brickwork, which is sometimes faced on the outside with porcelain.

Stow, John, English historian and antiquary, born about 1525 in London, died 1605. He learned tailoring which was his father's business, but his bent was towards antiquarian research. His studies and the books in his possession brought him under the suspicion of the ecclesiastical authority, but the attempts to incriminate him as a Papist failed. The chief publications of Stow were: *A Summary of Englische Chronicles* (1561); *Annales, or a Generale Chronicle of England from Brute until the present Yeare of Christe* (1580); and *A Survey of London* (1598). He also printed the *Flores Historiarum* of Matthew of Westminster (1567), the *Chronicle* of Matthew of Paris (1571), and the *Historia Brevis* of Thomas Walsingham (1574).

Stowe (stō), Harriet Elizabeth, American novelist and abolitionist, the daughter of the Rev. Lyman Beecher and sister to Rev. Henry Ward Beecher, was born at Litchfield, Connecticut, in 1812, and died in 1896. She became associated with her sister Catherine in teaching a school at Hartford; removed to Cincinnati, and there married the Rev. Calvin E. Stowe in

1836. She wrote several tales and sketches, and contributed to *The National Era*, a newspaper published at Washington, the serial story of *Uncle Tom's Cabin*; this tale was issued in book form in 1852, when it achieved an enormous success both in the United States and Europe. Among her other numerous writings are: *Sunny Memories of Foreign Lands* (1854); *Dred, a Tale of the Dismal Swamp* (1859); *The Minister's Wooing* (1859); and *Lady Byron Vindicated* (1870).—Cf. C. E. and L. B. Stowe, *Harriet Beecher Stowe: the Story of her Life.*

Stow-market, a town of Suffolk, England, on the Gipping. There are manufactures of gun-cotton, carriages, malt, &c., and an extensive trade. Pop. (1921), 4200.

Strabane (strȧ-băn′), a market town of Tyrone, Ireland, on the Mourne, near its confluence with the Finn. Shirt-making is the chief industry. Pop. (1921), 5100.

Strabo, Greek geographer, a native of Amasia, in Pontus, was born about 54 B.C., and died about A.D. 21. His earliest writings were his *Historical Memoirs* and a *Continuation of Polybius*, both of which are now lost. His great work, however, on geography, in seventeen books, has been preserved entire, with the exception of the seventh book, of which there is only an epitome. The first two books are introductory, the next ten treat of Europe, the four following of Asia, and the last of Africa. Strabo's *magnum opus* includes notices of important political events, and of chief cities and their great men. It has been translated by H. L. Jones (Loeb Library).

Stradella, Alessandro, born at Naples about 1645, was chapel-master at Genoa, and composed oratorios, cantatas, madrigals, and operas. At Venice he became enamoured of one of his pupils named Ortensia, the mistress of a Venetian noble, who eloped with him to Rome. They were followed, and three several attempts made by hired assassins to murder them. This was ultimately accomplished (1678) in Genoa. This tragical story forms the subject of an opera by Flotow.

Stradiva′ri, Antonio (Stradivarius), Italian violin-maker, born in Cremona, Italy, about 1649, died 1737. He was a pupil of Nicolo Amati, in whose employment he remained until 1700, when he began making on his own account. It was he who settled the typical pattern of the Cremona violin, and his instruments, for tone and finish, have never yet been excelled. His improvements consisted chiefly in lowering the height of the arch of the belly, in making the four corner-blocks more massive, in giving greater curvature to the middle ribs, and in altering the setting of the sound-holes.—Cf. W. H., A. F., and A. E. Hill, *Antonio Stradivari: his Life and Work*

Strafford, Thomas Wentworth, Earl of, English statesman, born in London 1593, died 1641. The eldest son of Sir William Wentworth, he was educated at St. John's College, Cambridge, and after leaving the university received the honour of knighthood. He sat in Parliament for Yorkshire for a number of years, and when Charles I asserted that the Commons enjoyed no rights but by royal permission, he was strongly opposed by Sir Thomas Wentworth. In this struggle his abilities were recognized, and high terms offered him by the court, which he accepted, and in 1628 was created Baron Wentworth, Privy Councillor, and President of the Council of the North. In the exercise of this authority he commended himself to Archbishop Laud, who selected him to proceed to Ireland as Lord-Deputy in 1632. Here he greatly improved the state of the country, alike as regarded law, revenue, and trade; but to accomplish his ends he did not scruple to use the strongest and most arbitrary measures. For these services he was created Earl of Strafford. When the Long Parliament met, the very first movement of the party opposed to arbitrary power was to impeach Strafford of high treason, with which charge Pym appeared at the bar of the House of Lords in 1640. His defence, however, was so strong that the original impeachment was deserted for a bill of attainder. The Bill passed the Commons by a great majority, and was feebly supported by the House of Lords. The king endeavoured to secure his safety, but yielded to the advice of his counsellors, backed by a letter from Strafford himself, who urged him, for his own safety, to ratify the Bill. Strafford was accordingly beheaded on Tower Hill in May, 1641.—BIBLIOGRAPHY: S. R. Gardiner, *History of England, 1603–1642*; H. D. Traill, *Lord Strafford*; Radcliffe (editor), *The Earl of Strafford's Letters and Despatches, with an Essay towards his Life.*

Straits Settlements, a Crown colony of British Malaya, comprising (1) Singapore Island, Christmas Island, Keeling or Cocos group, Labuan; (2) Penang, Wellesley, Dindings (with Pangkor Island); (3) Malacca. Section (1) forms the division of Singapore, (2) that of Penang, and (3) is self-contained. The Straits Settlements (excluding Christmas and Labuan Islands and the Cocos) form a series of distinct colonies fringing the western shores of the Malay Peninsula, and have a total area of about 1618 sq. miles, carrying a population of 882,000 souls (including 9200 Europeans and 10,000 Eurasians). *Government.*—Singapore is the seat of government. There is a Governor, who is also High Commissioner for the Federated Malay States, Commissioner for Brunei, and Agent for North Borneo and Sarawak. He is assisted by an Executive Council and a Legislative Council (11 official and 8 unofficial members). At Singapore, Penang, and Malacca there are municipalities, which are administered by nominated Boards of Commissioners. *Money, &c.*—The dollar has a sterling value of 2*s.* 4*d.* Native weights are the *kati* of 16 *tahil* (1⅓ lb.), 100 *kati* being equal to 1 *picul* or 133⅓ lb., and 40 *picul* = 1 *koyan* or 5333⅓ lb. For production, &c., see *Malaya* and articles on settlements and towns.

Stralsund (sträl′zṳnt), a seaport-town of Prussia, in Pomerania, on the strait which separates the Island of Rügen from the mainland. The manufactures consist of iron castings, machinery, sugar, &c., and there is a trade in grain and timber. Stralsund was founded in 1209 by Prince Jaromir I of Rügen, and peopled with Saxons. It afterwards became a free Imperial and Hanse town, and rose to great commercial importance. The railway from Berlin, maintaining the through service with Sweden via the Sassnitz-Trelleborg train-ferry, serves Stralsund. Pop. 33,980.

Strange, Sir Robert, British engraver, born in the Orkney Isles 1721, died 1792. He studied law and attempted a seafaring life, but ultimately resolved to devote himself to painting. While thus engaged the rebellion of 1745 broke out, and he joined the Highland forces in Edinburgh, where he engraved a half-length portrait of the Pretender. After the battle of Culloden he went to France, gained a prize for design at Rouen, resided for some time at Paris, and in 1751 settled in London and became the founder of the English school of historical engraving. He was knighted in 1787. His engraved plates, which number about eighty, evince an unusual combination of purity, breadth, and vigour.

Strangulation, a sudden and violent compression of the windpipe, constriction being applied directly to the neck, either around it (as in hanging) or in the forepart, so as to prevent the passage of air, and thereby suspend respiration and life. If animation is only suspended by strangulation, the methods of restoring it are much the same as in drowning (q.v.).

Stranraer (stran-ra̤r′), a royal and municipal burgh and seaport of Wigtownshire, Scotland, at the head of Loch Ryan. The principal buildings are the ruins of Kennedy Castle, which stand in the centre of the town, and the town hall and court-house. The chief trade is in agricultural produce, and there is a daily service of steamers to Ireland (Larne) in connection with the railway. Pop. (1921), 6100.

Strap-work, a style of architectural ornamentation or enrichment general in the fifteenth and sixteenth centuries, but of which specimens exist executed as far back as the eleventh century, consisting of a narrow fillet or band folded and crossed, and occasionally interlaced with another.

Stras′bourg (Ger. *Strassburg*), a city of France, capital of the post-European War department of Bas Rhin, on the Ill, at its confluence with the Breusch, 250 miles east by south of Paris, and about 370 miles south-west of Berlin; served by Rhine-Rhone and Rhine-Marne Canals to the Atlantic and Mediterranean, and an important strategic point as a railway junction. It has always been regarded as of great strategic importance,[1] and strong fortifications and a pentagonal citadel were erected by Vauban in 1682–4. After the siege of 1870 by the Prussians these were considerably altered and strengthened, and a new system of defence adopted, including fourteen detached forts. Among notable buildings are the cathedral, the church of St. Thomas, the Neue Kirche, the old town house (now Hôtel du Commerce), the old episcopal palace (now a municipal museum), the town house, the university buildings, and the palace erected for the German Emperor. The university was founded in 1567, and its library contains over 700,000 volumes. Industries include: tobacco, tanning, brewing, machinery, woollen and cotton goods, cutlery, musical instruments, artificial flowers, gloves, chemicals, and the preparation of Strasbourg's celebrated *pâtés de foie gras.* Under the name of *Argentoratum,* Strasbourg is supposed to have been founded by the Romans, who erected it as a barrier against the incursions of the Germans, who subsequently possessed it. In the sixth century the name was changed to Strasbourg, and in the beginning of the tenth century it became subject to the Emperors of Germany. United to France in 1681, it was ceded with the territories of Alsace and Lorraine to Germany in 1871, and returned to France in 1919. Pop. 166,767.

---

[1] The radiation of strategic railways demonstrates this point. The main line is the Strasbourg-Paris via Châlons and Bar-le-Duc, which bifurcates at Strasbourg; one section is continued up the left bank of the Rhine to Ludwigshafen and the Coblenz-Mainz system, and the other runs along the right bank to Karlsruhe and Heidelberg.

Strategy and Tactics. Strategy is the art of war which deals with the movements of troops within the theatre of war, or, alternatively, the art by which a commander or other responsible authority is enabled to formulate his plan of campaign. Tactics, on the other hand, is the art of moving troops in the presence of the enemy, or of carrying out the movements and operations necessary to bring the strategical plan to a successful conclusion. The two words are therefore complementary, and strategy depends more or less for its success on the tactical handling of troops by subordinate commanders. " A strategical plan which ignores the possibility of tactical success is foredoomed to failure" (*British Field Service Regulations*).

The aim of military strategy is the ultimate destruction of the enemy forces. Strategy deals with both facts and theories; tactics with facts only. Under the heading of strategic facts may be included: (1) the available strength on either side; (2) the extent of resources, both actual and potential, in money and material; (3) transport and communications generally; and (4) the nature of the probable theatre of operations. Strategic theory may be said to include: (1) the probable main objective of the enemy; (2) the power of both sides to replace losses in men and material; (3) the probability of other nations being involved on one side or another; and (4) the distribution of available enemy strength.

Strategy is the business of the General Staff as the military advisers of the Government, and it is the duty of the General Staff, in time of peace, to formulate plans of campaign to meet any possible emergency which may arise through the action of a single nation or group of nations. To do this satisfactorily, the military advisers must be kept in touch with foreign affairs, and must receive information of events as they become known; they must also keep themselves in touch with foreign military matters by means of their own sources of information (see *Espionage*). For example, the total available fighting strength of any country—i.e. on mobilization—is, to all intents, a matter of common knowledge; thus a sufficiently reliable fact is afforded. But the distribution of this man-power in the event of war is by no means a fact, as the French found in 1914. Their plan of campaign had assumed that the Germans would employ their reserves in secondary duties, and would not throw them into the first line, and the French strategy was based on this conception. When the actual clash came, about 100,000 German reserves were found to have been drafted into the actual first-line army. This fact seriously affected the French strategy as embodied in the plan of campaign. Successful strategy is dependent upon the capacity of the Staff to take risks, but not unnecessary risks, and the variability of the influential factors concerned makes strategy impossible as an exact science. Policy and public opinion may change; allies may default; weather may be unseasonable, or food and raw materials may fail. Also, in these modern days of scientific progress, new means of waging war, either directly or indirectly, may change the whole course of events, and make it necessary to remodel the general scheme time after time. Every possibility must receive careful consideration. For example, the French plan of campaign in 1914 counted on quick results, and totally ignored the possibility of a German occupation of parts of the country. When this occupation became a fact, it was found that it included the whole of the Briey ore-producing district, and that thereafter all ore required for munitions had to be imported. As the British Field Service Regulations insist, " Success will depend upon . . . rapid mobilization and concentration, and keeping the army supplied with its daily requirements in *personnel and material*". For naval strategy, see *Navy* (*General Functions*).

Stratford-on-Avon, a municipal borough and market town of Warwickshire, England, famous as the birth-place of Shakespeare. The chief objects of interest are the house in which Shakespeare was born, and the parish church (Holy Trinity) in which he and his wife, Anne Hathaway, were buried. The interior was restored in 1840, and the tower rebuilt with the old material in 1867. Shakespeare's remains were interred in the chancel, and against the north wall are his monument and bust. There are several other churches, and the Shakespeare Memorial Theatre (1878), library, and picture-gallery. Pop. (1921), 9400.—Cf. Sir Sidney Lee, *Stratford-on-Avon*.

Strath, in Scotland, a valley of considerable size, often having a river running through it and giving it its distinctive appellation. The word *strath* is derived from the Gaelic *srath*; Cymric, *ystrad*, meaning, a valley or valley bottom. Scottish straths are found chiefly in the east and centre, *glens* mainly in the west, and *dales* south of the Forth and Clyde estuaries.

Stratha'ven, a town of Lanarkshire, Scotland, on the Powmillon (Pomilion) Burn, about a mile from its confluence with the Avon. Strathaven is an agricultural centre and market town, and has a ruined castle built by Andrew Stewart, grandson of Murdoch, 2nd Duke of Albany, who obtained the barony of Avondale in 1456 and became Lord Avondale a year later. The town, which grew up around the castle, became a burgh of barony in 1450. Pop. 5000.

Strathclyde', a Welsh-Keltic (Brythonic) kingdom of ancient Scotland. After the Roman withdrawal (fifth century) Rydderch Hael (Hen) of Strathclyde, the friend and contemporary of St Columba and St. Kentigern (the patron of Gleschu (Glasgow) and the best known of their saints), gained a great victory (Ardderyd, 573) over the other Brythonic princes; his domains included the modern shires of Dumbarton, Renfrew, Lanark, Ayr, Peebles, Dumfries, Cumberland, and Westmorland, the capital being *Alcluith* (*Alclyde*, Brythonic, 'height on the Clyde'; Gadhilic (i.e. Gaelic), *Dunbreaton*, 'hill or fort of the Britons), the rock of Dumbarton. *Caer Luel* (Carlisle) was also a place of import ance. The Forest of Ettrick divided the Brythons from the Angles (English) of Bernicia on the east, but the general boundaries oscillated with the fortunes of war. The northern area was settled by the *Damnonii*, or Cornish branch of the Brythons. In the eleventh century Strathclyde was definitively incorporated in the Scottish kingdom, but, as Cumbria, lingered for many years as a principality, the appanage of the heir-apparent to the Scottish throne. The actual fusion was hastened by the death of Donald, the last Brythonic king claiming Roman descent (908), and the election of Donald, brother of Constantine, King of Alban, in his stead; Strathclyde thus became dependent on Alban till (1018) Eugenius the Bald, who was Malcolm II's ally at Carham, was succeeded by Duncan (the 'gracious Duncan' of *Macbeth*), grandson of Malcolm II. Malcolm died in 1034, and Duncan succeeded him as King of Scotia, the two crowns being united in his person and his family. In the early battles the Brythons were generally allied with the Scots of Dalriada (i.e. Christian allies) against the Picts and Angles (from Schleswig), who held pagan or semi-pagan beliefs.

Strathcona and Mount Royal, Donald Alexander Smith, first Baron, Canadian statesman, born in Scotland 1820, died 1914. He emigrated to Canada at the age of eighteen years, and became a clerk with the Hudson Bay Company, of which he was subsequently general manager and eventually governor. He is best known, however, as the colossal organizer to whose financial ability, commercial foresight, and indomitable will the Canadian Pacific Railway owes both its inception and its completion. It was begun in 1881 and completed in Nov., 1885. Smith was knighted in 1886, became Canadian High Commissioner in London (1896), and in the following year was elevated to the peerage. On his death (1st Jan., 1914) the title reverted by special remainder to his daughter.

Strathmore′, the general name given to the extensive valley of Scotland which stretches north-east from Dumbartonshire to Kincardineshire, having on one side the Grampians and on the other the Campsie, Ochil, and Sidlaw Hills; but it is popularly limited to the district which stretches from Methven, in Perthshire, to Brechin, in Forfarshire.

Strathnairn′, Hugh Henry Rose, Baron, British soldier, born 1801, died 1885. He entered the army in 1820, organized the Turkish defence against Mehemet Ali (1840), was for seven years Consul-General in Syria, and later chargé d'affaires at Constantinople. He served in the Crimean War and the suppression of the Indian Mutiny, succeeded Lord Clyde as commander-in-chief in India (1860), and from 1865 to 1870 was commander-in-chief in Ireland. He was raised to the peerage in 1866, and made field-marshal in 1877.

Strathpeffer, a village of Scotland, county of Ross and Cromarty, 4 miles west of Dingwall, with much-frequented sulphurous and chalybeate springs. Pop. 430.

Strathspey′, one of the national dances of Scotland, so called because it was first danced, or first became popular, in the valley or strath of the River Spey. The music derives its special character from the use almost throughout of time groups composed of a dotted quaver and semiquaver. When the shorter note comes first, as happens quite frequently, the national quality of the tune is so much enhanced that the special name of 'Scotch snap' has been given to this time arrangement, though the same device is also found in the folk-music of some other countries, notably Hungary. It will be seen therefore that the characteristic feature of strathspey music is the regular alternation of long and short notes. In this it is differentiated sharply from music for the reel in which the notes are all of equal value. The strathspey is always played at a slower pace than the reel. The music for both of these dances is pre-eminently fiddle music, and when it is played for its own sake, as is the favourite custom of country fiddlers, the strathspey is always given first, followed immediately, after a number of repetitions, by the more vivacious reel. Neil Gow (1727–1807) is generally regarded as the finest player of strathspeys and reels that Scotland has produced. Burns wrote some of his best songs to strathspey tunes, a good example of this being *Green grow the rashes, O.*

Stratum, in geology, plural *strata*, a layer of any deposited substance, as sand, clay, limestone, &c., which has been originally spread out over a certain surface by the action of water, or in some cases by wind, especially such a layer when forming one of a number superposed in a mass of sedimentary rock. When strata do not lie horizontally but are inclined, they are said to *dip* towards some point of the compass, and the angle they make with the horizontal plane is called the *angle of dip*. When strata protrude above the surface, or appear uncovered, they are said to *crop out*. They are said to be *conformable* when their planes are parallel, whatever their dip may be; and *unconformable* when there is a want of parallelism between successive series of strata.

Straubing, a town of Bavaria, Germany, on the Danube. There are tanneries, breweries, lime-, brick-, and cement-works. Pop. 22,000.

Strauss (strous), David Friedrich, German theologian, born 1808, died 1874. He studied in Tübingen and in Berlin under Schleiermacher and Hegel, returned to Tübingen and lectured on logic and philosophy. In 1835 he published his *Life of Jesus*, in which he attempted to prove that the gospel narratives had a mythical origin and growth. To his numerous critics he replied in *Streitschriften* and *Zwei friedliche Blätter*. Appointed in 1839 to the chair of dogmatic theology in Zürich, he was prevented from entering upon his duties by a storm of popular indignation, but received a small pension in recompense. His subsequent writings were: *Christliche Glaubenslehre* (1839–41), *Life of Schubert* (1849), *Life of Christian Märklin* (1851), *Life of Ulrich von Hutten* (1858–60), *Leben Jesu für das Deutsche Volk* (Life of Jesus for the German People, 1877), *Der Christus des Glaubens und der Jesus der Geschichte* (The Christ of Faith and the Jesus of History, 1865), and *Der alte und der neue Glaube* (The Old and the New Faith, 1872), in which he defines his final attitude to Christianity, that being now entirely hostile. His more important works have been translated into English. His works were edited, with an introduction, by E. Zeller (12 vols.).—Cf. E. Zeller, *D. F. Strauss in seinen Leben und seinen Schriften.*

Strauss, Johann, Austrian composer, born 1825, died 1899. The son of Johann Strauss (1805–49), a Viennese dance-music composer, he toured Europe, and was long at the head of a famous orchestra in Vienna. He wrote over 400 waltzes (e.g. *The Blue Danube*), many of them world-famous, and was the author of several operettas.

Strauss, Richard, the latest and greatest among famous musicians of that name. Unlike Johann and Edward, to whom he is quite unrelated, Richard has achieved greatness not in the realm of the waltz and the operetta but in the loftier sphere of the symphonic poem and the opera. For many years he was the most outstanding figure in the whole world of music, but from about the beginning of the second decade of the present century he has had to compete with an ever-increasing number of composers possessing equally commanding gifts. Now (1923), his former position as leading revolutionary in musical composition is occupied by a numerous band of younger and even more daring pioneers.

He was born at Munich, in 1864, into a musical home, his father being a professional musician and a player of the French horn. He early showed a natural talent for music, and began composing at the age of six. His musical studies included piano and violin, as well as the subjects more directly required for a future composer, and to these was wisely added a wide general education. He soon gave proof that he had power as a conductor, and made his first appearance in this capacity in 1885, holding regular appointment subsequently in Weimar, Munich, and Berlin. At the present time he is stationed in Vienna In 1896 he began an extensive series of tours a composer and conductor which extended ove two years and included London, where he mad his first appearance in 1897. In 1903 he conducted the Amsterdam orchestra at the St James' Hall, London, in a Strauss Festival whic lasted some days.

Strauss may be said to have done for th symphonic poem what Wagner did for the opera The symphonic poem as originated by Liszt an practised by his immediate followers had no been fully successful, since the avowed desir to tell a story or faithfully depict a mood o dramatic situation in purely instrumental musi had been hampered, quite naturally, by lingering adherence to the established forms o classical composition. Strauss in his remarkabl series of symphonic poems not only showe greater daring in his choice of subjects fo musical treatment, but also succeeded by hi genius in modifying his form on each occasio to suit the compelling needs of his subject. I two instances he used the established forms bu interpreted their obligations with characteristi freedom. Thus, *Tyl Owlglas' Merry Pranks* i appropriately cast in a kind of rondo form, an *Don Quixote* is with equal appropriateness a fre kind of Theme with variations. *Also sprac Zarathustra* is a remarkably interesting attem to express in music the essentials of Nietzsche famous treatise. This work on its first appearan caused particular discussion, but there is n denying its effectiveness as music, nor t cleverness of the means adopted to give a equivalent in sounds for certain aspects philosophy. The much-debated close—in whic while the chord of B major is sustained ve softly in the high registers, the double-bass give the note C natural pizzicato very low dow —is a legitimate musical expression of the i solubility of the enigma of life, and as contriv by the composer is without offence to an u prejudiced ear. Strauss did not scruple to tran late ugly thoughts into ugly music, some of t earliest examples of this being found in *E Heldenleben*, where the snarling of the critics represented with startling success, and t battle scene reproduced with much of t cacophony that attends the actual event. H later works, including the *Rosenkavalier*, *Ariad auf. Naxos*, *Josephs Legende*, and the *Alpe symphonie*, are, by general consent, disappointi and it is impossible to escape the conviction th much of the early fire and sheer cleverness ha departed. Nevertheless, he still remains one the mentally keenest of composers, and one the greatest masters of orchestration. He h done comparatively little in the smaller forms, but mention must be made of his songs, the finest of which are full of a delicate poetry and genuinely beautiful.

Stravinsky, Igor Fedorovitch, was born near Petrograd on 5th June, 1882. His father was a bass singer at the court there, and had decided that his son should become a lawyer. But at the age of twenty young Stravinsky met Rimsky-Korsakoff, and at once gave up all idea of studying the law, taking up instead the serious study of music with his new friend. He remained with Rimsky-Korsakoff for four years. The first work to win him notice was a *Scherzo fantastique* based on Maeterlinck's *Life of the Bee*. This was written in 1908. Two years later his music for the ballet *L'oiseau de feu* was first performed, followed in 1911 by *Petruschka*. *Le Sacre du Printemps* dates from 1913, and, with the opera *Le Rossignol* and an early work for orchestra, *Feurswerk*, completes the catalogue of his important compositions so far produced (1923).

Stravinsky's music has divided the company of critics into two parties, who respectively praise and condemn with equal enthusiasm. The composer has disavowed any intention of writing music that shall be expressive in the accepted fashion. He desires to avoid all that is in any way emotionally eloquent, and wishes to affect his hearers by means of sound as sound and rhythm as rhythm. The outstanding feature of his music is its amazing vitality. If he should succeed in establishing himself as a composer, he will have earned a place among the greatest musicians, for he will have been the pioneer and justifier of something quite new in musical composition.

Strawberry, a well-known fruit and plant of the genus Fragaria, nat. ord. Rosaceæ. It is remarkable for the manner in which the receptacle, commonly called the fruit, increases and becomes succulent; but the true fruit is the small seeds or achenes on the surface of the receptacle. The species are perennial plants throwing out runners which take root and produce new plants; they are natives of temperate and cold climates in Europe, America, and Asia. The following species afford the varieties of cultivated strawberries: (1) Wood strawberry (*F. vesca*), found wild in woods and on hill-sides throughout Europe, and now cultivated in gardens, as the red, the white, the American, and Danish Alpine strawberries. (2) The Alpine strawberry (*F. collīna*), a native of Switzerland and Germany. The varieties of strawberries called green are the produce of this species. (3) Hautbois strawberry (*F. elatior*), a native of North America. (4) Virginian strawberry (*F. virginiana* or *caroliniana*), a native of Virginia. To this species belongs a great list of kinds cultivated in gardens, and known by the name of scarlet and black strawberries. (5) Large-flowered strawberry (*F. grandiflōra*) is supposed to be a native of Surinam, and to have furnished our gardens with the kind called pine strawberries. (6) Chile strawberry (*F. chilensis*), a native of Chile and Peru, and the parent of a number of mostly inferior strawberries. Strawberries are much valued for dessert, and for purposes of jam-making. The strawberry thrives in any good garden soil, and is propagated by seeds, by division of the plant, and by runners.

Strawberry-pear, a plant of the cactus family, the *Cereus triangulāris*, which grows in the West India Islands. Its fruit is sweetish, slightly acid, pleasant, and cooling.

Strawberry-tomato, the name of a plant of the genus Physălis (*P. Alkekengi*), nat. ord. Solanaceæ, known also as *winter-cherry*, cultivated for its fruit, which is of a bright-red colour, of the size of a small cherry, and makes a delicate sweetmeat.

Straw Plait, straw plaited or braided into strips or tissues of some size for making hats, bags, ornaments, &c. In the manufacture of straw hats the straw must be of a certain length between the knots and must not be brittle; and these qualities are found most frequently in the wheat grown in Tuscany, where the well-known Leghorn hats are made. When the grain is still green, the straw is pulled up by the roots, dried in the sun, bleached by means of sulphurous fumes, split by a machine, and then plaited into hats by women and young children as a domestic industry. Certain kinds of wheat cultivated around Luton, in Bedfordshire, were found suitable for plaiting, from which cause it became the centre of the straw-plait industry in England. Straw plait is now made in various other countries, including Switzerland, Holland, and Belgium. Great quantities of braid are now exported from China, partly to the United States, where the making of hats, &c., from imported plait is now an extensive industry.

Street, George Edmund, British architect, born 1824, died 1881. Having studied architecture under Sir Gilbert Scott, in 1850 he began work on his own account. He favoured the English Gothic style, and in this his principal works were built. The chief of these were the new law-courts in the Strand, London, for which he was appointed architect in 1868, after competition. He was elected a Royal Academician in 1871.

Strelitzia, a genus of large monocotyledonous herbs, order Musaceæ, often grown in hothouses for the sake of their brilliantly coloured (orange and blue) and curiously formed flowers, which are borne in boat-shaped bracts. They are said to be pollinated by birds.

Strength of Materials, that part of the theory of engineering which is concerned with the properties of the various materials used, such as wrought iron, cast iron, mild steel, tool steel, brass, aluminium, concrete, cement, bricks, stone, and timber; with the determination of these properties by testing in suitable machines; and with the study of the effects of combinations of different types of stresses and the repeated or alternate action of stress. The term *stress* is given to the cohesive force which resists the load. It may be tensile, compressive, or shearing, or a combination of these (see *Elasticity*). Material stressed beyond the elastic limit will not return to its original dimensions, a *permanent set* being produced. Working stresses on materials are always kept much lower than the elastic limit and are dealt with as the *ultimate* or *breaking stress* divided by a number known as the *factor of safety.*

In the *testing machines* used to determine the strength constants of various substances the pull is exerted by turning a screw by gear, but in large machines hydraulic pressures are usually employed, and the load is generally measured by balancing it with a weight on a system of levers. The test specimens are prepared with suitably shaped ends for fixing in the shackles or grips, and of length sufficient to make the effects on the measured length of the large ends negligible. When a plain bar is broken in tension or compression, the lines of cleavage on the broken surface make an angle of about 45° with the axis. Instruments designed to record graphically the stress-strain diagram of a test specimen are in common use in materials-testing laboratories. Continuously varied or alternated stresses *fatigue* metals, and after a time cause their collapse under even moderate loadings. A. Wöhler experimented from 1860 to 1870 (see *Engineering*, 1871) with various changes of repeated loadings, and showed that a stress much less than the ultimate strength is sufficient to cause rupture if it is often enough applied and removed or reversed or even varied with a smaller stress of the same nature. Professor W. C. Unwin brought the results of these investigations and those of other experimenters together, and reduced them to a general equation (see W. C. Unwin, *Testing of Materials of Construction*). The addition of even small quantities of other substances to metals may produce great changes in their physical properties. Silicon, phosphorus, nickel, chromium, manganese, and sulphur all have effects of this character upon steel.

Mathematics of Simple Cases.—For a brief analysis of the fundamental relations between stress and strain, see *Elasticity.* One or two examples of great practical importance will now be given.

(1) The *bulk modulus.*—When a body is subjected to hydrostatic pressure, the fraction (decrease of volume)/(original volume) is taken as the strain, and the pressure (p) as the stress; the fraction (stress)/(strain) is the bulk modulus. In this case $\overline{xx} = \overline{yy} = \overline{zz} = p$, and the three other components of stress are zero. We may take $u = -ex$, $v = -ey$, $w = -ez$, where e is a small number. The stress p is $\overline{xx}$ or $-e(3\lambda + 2\mu)$. Also a cube of side a is strained into a cube of side $(1 - e)a$; its strained volume is $(1 - e)^3a^3$, or $(1 - 3e)a^3$ nearly; the strain is therefore $-3e$. Hence the bulk modulus k is $\frac{1}{3}(3\lambda + 2\mu)$.

(2) *Young's Modulus.*—If a bar of uniform section is stretched (or compressed) by forces applied at its ends only, the strain is (change o length)/(original length). All the stresses vanish except $\overline{zz}$, if the length of the bar is parallel to the z-axis. We may take $u = -g\sigma x$, $v = -g\sigma y$ $w = gz$, where g is small, and σ is a constant to be found. A length l parallel to Oz become $l + w = l + gl$, so that g is the strain. The stresses are $\overline{xx} = \lambda(1 - 2\sigma) - 2\mu\sigma = \overline{yy}$, an $\overline{zz} = \lambda(1 - 2\sigma) + 2\mu$. Since $\overline{xx} = 0$, we ge $\sigma = \frac{1}{2}\lambda/(\lambda + \mu)$, and $\overline{zz} = g\mu(3\lambda + 2\mu)/(\lambda + \mu)$ Hence Young's modulus $E = \overline{zz}/g = \mu(3\lambda + 2\mu)/(\lambda + \mu)$. The values of u and v show tha $g\sigma$ is the (proportional) lateral contraction, s that σ = (lateral contraction)/(longitudinal ex tension); σ is called *Poisson's ratio*, and is abou $\frac{1}{3}$ or $\frac{1}{4}$ for most materials.

We have found k, σ, and E in terms of λ an μ. There are therefore only two independen constants among these five, and all can be expressed in terms of any two. Thus, for example $E = 9k\mu/(3k + \mu)$, $E = 2\mu(1 + \sigma)$, an $E = 3k(1 - 2\sigma)$.

Numerical Data.—*Young's modulus* in tons pe square inch: cast iron, 6000 to 9000; wrough iron, 12,000 to 13,000; malleable cast iron 11,500 to 12,000; mild steel (structural), 13,000 In these cases the *modulus of rigidity* (or *shea modulus* or *shape modulus*) is about $\frac{2}{5}$ of Young' modulus. *Safety stresses* (*tensile and compressive* in tons per square inch: cast iron, 1½ tension, compression; wrought iron, 5 tension, 4 compression; mild steel, 6 tension or compressio steel castings, 5 tension, 6 to 8 compressio copper rods, 1½ tension, 1¼ compression.

Bibliography: A. Morley, *Strength of Material* *Modern Mechanical Engineering* (The Gresha Publishing Company), vol. ii.

Strepsip'tera ('twisted-winged'), a sma and very peculiar and anomalous order insects, possibly related to the beetles. Th females are wingless, and live as parasites i the abdomen of bees, wasps, and other hymenopterous insects. The males have the fro pair of wings in the form of twisted filaments, the posterior pair being fan-shaped and membranous. The jaws are rudimentary. The tails of the parasitic females protrude from between the abdominal joints of their host. The strepsiptera are viviparous, and the larvæ are little caterpillars which attach themselves to the bodies of wasps and bees. The female larvæ never leave their hosts; the male larvæ undergo their metamorphosis within the bodies of their hosts, from which in due time they emerge as perfect winged males. *Stylops dalii* and *Xenos rossii* are common species.

Streptocarpus, a genus of African herbs, order Gesneraceæ. *S. polyanthus* is often grown in greenhouses for its showy flowers; the plant has but a single large leaf, which represents one of the original seed-leaves (cotyledons), the other dying off early and no further leaves being formed.

Streptococcus, spheroidal bacteria occurring in chains. They include the species causing erysipelas, and are associated with inflammatory processes. Other kinds are responsible for the wholesome souring of milk and ripening of cream.

Stretford, an urban district of Lancashire, England, 4 miles from Manchester. Pop. 46,500.

Strickland, Agnes, British historian, born 1796, died 1874. She wrote, in collaboration with her sister Elizabeth, *Lives of the Queens of England* (12 vols., 1840–8), and *Lives of the Queens of Scotland* (8 vols., 1850–9). She also published *Letters of Mary Queen of Scots*, with an historical introduction and notes; *Lives of the Bachelor Kings of England*; *Lives of the Tudor Princesses*; poems, stories, &c.

Stricture, a contraction of a tube, duct, or orifice; for instance, of any part of the alimentary canal or of the urinary passages.

Striegau (strē′gou), a town of Prussia, in the province of Silesia. It has granite-quarries and polishing-works, and linens, woollens, leather, brushes, and tobacco are manufactured. On 4th June, 1745, the Austrians and Saxons were defeated at Striegau by Frederick the Great. Pop. 15,000.

Strike, in geology, the direction of a horizontal line drawn in the surface of an uptilted stratum. It is at right angles to the dip.

Strike. When a number of workmen agree together to stop work for the purpose of obtaining a change in the conditions of their employment, their action is termed a *strike.* A stoppage of work occasioned by the action of employers is called a *lock-out*; but in practice it is difficult to distinguish between the two forms. In times of improving trade, workmen may properly demand that their wages shall be raised; and if a demand of this kind be refused, the result will possibly be a strike. Similarly, employers may be compelled by declining trade to lower wages, yet if the men will not accept the conditions imposed by necessity, the stoppage of work is technically a lock-out. As public sympathy is generally sought by both sides in a trade dispute, this rather arbitrary distinction between a strike and a lock-out is often the subject of hot debate. Thus the stoppage of work in the coal-mining industry in 1921 was technically a lock-out, since the mine-owners refused to renew contracts of employment at the rates of pay which had been maintained during the period of State control, arising out of the exigencies of the European War. Ministers, however, who wished to adopt an impartial attitude, avoided the use of the terms ‘ strike ’ or ‘ lock-out ’, and referred to the dispute as a *stoppage.*

Trade Unions.—Since trade unions have become general in industry, as the instruments through which collective bargaining is conducted, they have naturally become responsible for the organization and conduct of the great majority of strikes. It by no means follows, however, that the unions are the cause of the strikes, or that there is any necessary connection between the two. There are some trade unions which prefer the method of mutual insurance to that of collective bargaining, and do not therefore engage in strikes at all. Moreover, strikes have been far more numerous in industries which have practised collective bargaining without trade unions than in those which have organized themselves in this way. The Royal Commission on Labour (1891–4) reported, "that when both sides in a trade are strongly organized, and in possession of considerable financial resources, a trade conflict, when it does occur, may be on a very large scale, very protracted, and very costly. But just as a modern war between two European states, costly though it is, seems to represent a higher state of civilization than the incessant local fights and border raids which occur in times and places where Governments are less strong and centralized, so, on the whole, an occasional great trade conflict breaking in upon years of peace, seems to be preferable to continued local bickerings, stoppages of work, and petty conflicts."

Alternatives.—Three different methods of settling industrial disputes without resort to strikes and lock-outs have been advocated and sometimes adopted. They are: (1) arbitration, (2) conciliation, and (3) legal enactment. *Arbitration* consists in the appointment of a third party as an impartial umpire, before whom employers and employed may each lay their case for an equitable decision. This method is extremely valuable for the interpretation of the terms of a contract. It is constantly used in business matters as an alternative to going to law. It is not, however, easily applicable to circumstances, such as those which most frequently give rise to trade disputes, in which there is fundamental disagreement between the parties as to the principles upon which a settlement should be based. In *conciliation* a third party is asked to intervene, not as an impartial umpire, but as a friendly negotiator or 'honest broker', who will examine the claims made on each side, clear up misunderstandings, and in conversation with each of the parties to a dispute in turn, draw out their strong arguments, ascertain the points to which they really attach fundamental importance, and persuade them by degrees to come to a compromise. This method is playing a great part in the industrial field at the present time, and is likely to be increasingly adopted. *Legal enactment* involves the intervention of the State. In New Zealand a system of compulsory arbitration has been in force since 1894, though the precise terms of the law are continually being altered. According to a consolidation Act of 1908, all disputes must be taken, in the first instance, to a Council of Conciliation, representing the two sides, with an impartial chairman. Failing a settlement, the dispute must, after two months, be referred to the Central Court of Arbitration, which decides it absolutely. There are severe penalties for a breach of an award and for attempts to bring about a strike or lock-out.

As industrial federations become larger in Great Britain, and the general public more seriously menaced by the dislocation which accompanies a big dispute, legislation of the kind adopted in New Zealand is frequently suggested here. Even Mr. and Mrs. Sidney Webb, whose patient advocacy of the claims of labour is well known, say in their book (*Industrial Democracy*), that "when in the course of bargaining there ensues a deadlock—when the workmen strike, or the employers lock-out—many other interests are affected than those of the parties concerned. We may accordingly expect that, whenever an industrial dispute reaches a certain magnitude, a democratic State will, in the interests of the community as a whole, not scruple to intervene, and settle the points at issue by an authoritative fiat." The British Government, in fact, was very nearly compelled to intervene in this way during the railway strike of 1919, and again during the coal stoppage of 1921. On both occasions the whole industry and life of the country were threatened with paralysis; while, during the latter dispute, there seemed to be grave reason to fear that the terms of the Triple Alliance between the Coal Miners' Federation, the National Union of Railwaymen, and the Transport Workers' Federation would force the two latte organizations to throw in their lot with th miners. In the event, however, this dange was averted, and the Prime Minister playe the part of conciliator without resorting t compulsory powers.

Legislation.—Since the passing of the Con spiracy and Protection of Property Act of 187 the organization of strikes has ceased to be criminal offence, but, until 1906, employer could recover damages both from their workme and also from a trade union for breach of con tract. When a strike has been declared, it the practice of strikers to post certain of the number at the entrances of factories, or at oth convenient spots, to persuade their fello workmen to join them. This is called 'picke ing'. In 1896 and 1899, however, the cour decided that picketing was illegal. In 190 moreover, the decision of the House of Lor in the Taff Vale Railway case showed that trade union could be sued in tort for acts do by its agents within the scope of their authorit and might be sued in its collective capacit These two decisions went far towards destroyi the power of trade unions to conduct collecti bargaining on behalf of their members. 1906, therefore, the Trade Disputes Act w passed to amend the law on these points. T Act provides (*a*) that an act done by a co bination of two or more persons in furtheran of a trade dispute shall not be actionable unl the act, if done without such combinati would be actionable; (*b*) that picketing lawful "for the purpose of peacefully obta ing or communicating information, or of pea fully persuading any person to work or abst from working"; (*c*) that an act done in f therance of a trade dispute is not actiona on the ground only that it induces some pers to break a contract of employment, or on ground of interference with business or empl ment; (*d*) that an action against a trade uni may not be entertained by any court.

Causes.—Disputes may arise in the course collective bargaining for a great variety of reaso Most strikes and lock-outs, however, are o questions of wages, a smaller number ab hours of labour, while others arise out of qu tions of trade union practice. In the last-nam category are strikes for the recognition o union by the employers, against the empl ment of non-unionists, against the dismissal a member of a union, and 'demarcation' putes between two bodies of workmen as the border-line between their trades.

BIBLIOGRAPHY: J. H. Cohen, *Law and Orde Industry*; A. M. Bing, *War Time Strikes their Adjustment.*

Strindberg, August, Swedish author, b

1849, died 1912. In 1879 he published his first novel, *The Red Room.* His first play, *Mäster Olof,* written in 1872, was produced in 1878. In 1895 a mental breakdown necessitated his removal to a sanatorium, where he remained for two years. Strindberg was three times married and three times divorced, and his unhappy married life explained his bitterness against women. Strindberg's numerous works include: *A Fool's Confession* (wherein he gives an account of his first marriage); *Legends*; *Marriage*; *The Natives of Hemsö,* a novel of Swedish peasant life; *Gustavus Vasa* and *The Last Knight* (historical plays); and *The Dance of Death.*

Strobi'lus, in botany, a catkin the carpels of which are scale-like, spread open, and bear naked seeds, as in the fruit of the pines; a cone.

Strom'boli, one of the Lipari Islands in the Mediterranean, north of Sicily. It contains the active volcano Stromboli, the ' lighthouse of the Mediterranean ', 3000 feet altitude. Area of island, 5 sq. miles; pop. 2500.

Strombus, the name given by Linnæus to a genus of sea-snails, now broken up into several genera. The aperture is much dilated, the lip expanding and produced into a groove. In some of the shells of this genus there are spines of great length arranged round the circumference of the base, being at first tubular, and afterwards solid, according to the period of growth. The giant strombus (*S. gigas*), or fountain-shell of the West Indies, often forms an ornament in houses, and is largely used for cameos and in porcelain-works. Pink pearls are obtained from this species.

Strongbow, the surname of Richard de Clare of Striguil (*Estrighoiel* of Domesday survey, modern Chepstow), second Earl of Pembroke, who succeeded his father, Gilbert de Clare, in 1148, but lost his estates about 1168, and in 1170 crossed to Ireland at the request of Dermot, King of Leinster, whose domains had been subjugated by Roderick of Connaught, took Dublin, Waterford, and other places, and re-established Dermot on his throne. Strongbow married Eva, daughter of Dermot, on whose death he ascended the throne of Leinster. There was an immediate rebellion, and a further invasion by Roderick, and Strongbow hastened to England, where he acknowledged the overlordship of Henry II, whereupon that monarch crossed to Ireland (1172) with an army, and occupied all the strong places. Strongbow subsequently served in France (1173), and received Leinster again from Henry II. In 1176 he died.

Strongyles (stron'ji-les), or **Palisade Worms,** parasitic round-worms making up the family Strongylidæ. They include: the lung worms (*Eustrongylus filaria*), causing husk or hoose in lambs; armed strongyle (*Sclerostomum armatum*), in large intestine of horse; giant strongyle (*S. gigas*), infesting kidneys of horse and man, and the female of which is almost 1 foot in length.

Stronsay, one of the Orkney Islands, 12 miles north-east of Kirkwall; about 7 miles long and 4½ miles broad. Pop. (1921), 1100.

Strontium (symbol, Sr; atomic weight, 87·63), one of the alkaline earth metals, closely related to calcium and barium, but less abundant than either of these. The oxide is *strontia* (SrO). The chief source of the element is the carbonate $SrCO_3$, *strontianite,* which was first discovered at Strontian, in Argyllshire. The hydroxide $Sr(OH)_2$ is used in sugar-refining to aid extraction. The nitrate $Sr(NO_3)_2$ is extensively used in the composition of fire-works. Most of the compounds impart a bright crimson colour to a flame.

Strophan'thin, a crystalline glucoside with strongly bitter taste, obtained from the seeds of *Strophanthus hispidus,* a plant belonging to the nat. ord. Apocyanaceæ. It is soluble in water, and gives characteristic colours with mineral acids. It is very toxic, and is the active principle of the seed strophanthus used as an arrow-poison in Africa.

Strophe (Gr. *strophē,* from *strepho,* I turn), the name of one of the divisions of a Greek choral ode, corresponding to the *antistrŏphē.* The singing of the strophes on the stage was accompanied with a motion or turn from right to left; the singing of the antistrophe, with a contrary motion, from the left to the right.

Stroud (stroud), an urban district and town of Gloucestershire, England, adjacent to the Slade and Frome. It is a centre for cloth-factories and dyeworks, and there are foundries, sawmills, and breweries. Pop. (1921), 8600.

Structures, Theory of, the study of the effects of the nature and distribution of loads upon simple forms or built-up frame structures. In practical constructions, the dimensions and properties of the materials used must be suitable to resist deformation. In designing a structure, the effects that may produce rupture must be studied before the sections of materials to be used are decided upon. Shearing and bending effects are studied, and their variation shown from section to section by diagrams from which the maximum values can be seen. The *shearing force* to be resisted at any section is the algebraic sum of all the vertical forces acting on the beam either to the right or left of the section. At any similar section the *bending moment* to be resisted is the algebraic sum of the moments, about that section, of the right or left series of forces. The reactions at the supports can be found by considering the structure as a loaded lever, or by the consideration that at the free end of a beam the total bending moment is zero. For any series of definite loads the bending moment diagram is a polygon. For a uniformly distributed load the line of moments is a parabolic curve. The loads upon a structure may be fixed or rolling. Girders that are subjected to the passage of a fast moving load should be designed with a lower working stress than when carrying a fixed load. The combined bending moment diagram for the fixed and moving loads would be used in such a case in the discussion of the strength requirements. When the bending moments are determined, the maximum stress per unit area (f) can be found from $f = \frac{My}{I}$, where M is the maximum bending moment, y the distance of the extreme layer from the neutral axis, and I is the *moment of inertia*, which is the summation of the small areas into which the section can be divided, multiplied by the squares of their distances from the neutral axis. From the equation a suitable section for the loading is obtained. Every structure is maintained in a state of equilibrium by the various loads acting upon it, namely, its own weight, the external loads, and the reactions at the supports. Force diagrams are drawn (see *Statics, Graphic*) to determine the loading of the various components of the structure. From the stresses so found the suitability of the chosen sections is determined. The wind and snow loads may be either treated in separate diagrams or all the loads at any point may be combined and the resultants used for a combined diagram. See *Elasticity*; *Strength of Materials*.

Struensee, Johann Friedrich, Count, Danish political philosopher, born 1737, died 1772. As physician to Christian VII of Denmark he became a court favourite, was appointed Minister of State (1771), gradually usurped all administrative powers, and caused his own elevation to the peerage. From an impartial standpoint, Struensee was one of the ablest constructive minds of eighteenth-century administration. He encouraged education, trade, and the freedom of the press, but was guilty of an improper liaison with Caroline Matilda, the queen (sister of George III of England), and was opposed by a powerful national party under the Crown Prince, and the dowager queen. Under pressure, Christian signed the warrant for the impeachment of Struensee (1772), who was tried for conspiracy and beheaded.

Struma, the chief river of Eastern Macedonia, Balkans. It rises 20 miles south of Sofia, and is a torrent in its upper course. On the plains of Jumaia and Melnik, which are very productive, the Struma's breadth is only 30 to 50 yards, and its depth 1½ to 3½ feet; it frequently overflows and changes its course. It enters the sea in the Gulf of Rendina (Orfani), forming first Lake Takhino (70 sq. miles). Length, 150 miles. The Struma (ancient *Strymon*) figured in the Salonika operations of the European War.

Strumitsa, a town of Serbia, on the Strumitsa River. It was taken by the Greeks in the second Balkan War (1913), fell to the French in Oct., 1915 (European War), was evacuated, and was in Germano-Turkish hands until 26th Sept., 1918, when British troops re-entered.

Strutt, Joseph, English antiquary, born at Chelmsford in 1749, died in 1802. In 1773 he published his *Regal and Ecclesiastical Antiquities from Edward the Confessor to Henry VIII* (new edition, 1842), and shortly afterwards his *Horda Angel-Cynnan, or Manners, Customs, &c., of the English* (1774-6, 3 vols., with 157 plates). His other works include a *Chronicle of England* (2 vols., 1777–8); *Biographical Dictionary of Engravers* (2 vols., 1785–6); *Dresses and Habits of the People of England, &c.* (2 vols., 1796–9, with 142 plates; new edition, 1875); and *Sports and Pastimes of the People of England* (40 plates, 1801; new edition, with 140 plates, 1827). He left some manuscripts, from which were afterwards published his *Queenhoo-Hall*, a romance, concluded by Sir Walter Scott; *Ancient Times*, a drama; also *The Test of Guilt, or Traits of Ancient Superstition*, a dramatic tale.

Struve (strö'vė), Friedrich Georg Wilhelm von, German astronomer, born 1793, died 1864. In 1813 he entered the Dorpat observatory, and was appointed director in 1817. On the completion of the Russian observatory at Pulkova, near St. Petersburg, in 1839, he was nominated director, and continued his researches on nebulæ and double stars. From 1816 to 1819 he was engaged on the triangulation of Livonia, and from 1830 to 1845 he was connected with the measurement of the arc of the meridian in the Baltic provinces, which was afterwards extended to the Arctic Ocean and the Danube.

Stry, or **Stryj** (strē), a town of Poland, in Galicia, on the Stryj. Leather goods and watches are made. Pop. 30,000.

Strychnine (strik'nin; $C_{21}H_{22}N_2O_2$), an alkaloid existing in nux-vomica, St. Ignatius' beans, and in the seeds of various other plants of the genus Strychnos (q.v.). It may be prepared by exhausting the crushed ripe seeds with very dilute hydrochloric acid, concentrating, adding milk of lime, and exhausting the precipitate with boiling alcohol, from which the strychnine is deposited on cooling. It crystallizes in the form of translucent trimetric prisms. It has an intensely bitter taste, and is very poisonous. One-eighth of a grain will kill a large dog; three-eighths of a grain produces violent spasms in man, and half a grain may be fatal. Strychnine acts upon the central nervous system, and stimulates the sense organs. It acts like a bitter, improving the appetite, and it is much used as a gastric tonic in dyspepsia. It is also used in cases of surgical shock and heart-failure, large doses (up to $\frac{1}{10}$ grain) being injected hypodermically. In a case of strychnine poisoning, potassium permanganate may be given to render the drug inactive, and emetics or the stomach-pump should be used. See *Toxicology.*

Chemically, strychnine is a mono-acid tertiary base. It yields quinoline and indole when fused with potash, and carbazole when heated with zinc dust. It is soluble in chloroform (1 in 6) and in boiling alcohol (1 in 12), but is nearly insoluble in ether.

Strychnos (strik'nos), a genus of plants, nat. ord. Loganiaceæ. It is composed of trees or shrubs which do not yield a milky juice, and have opposite, usually nerved leaves and corymbose flowers; some of the species are possessed of tendrils, and are climbing plants. They are found principally in the tropical parts of Asia and America. Among the species are *S. nux-vomica*, nux-vomica, poison-nut, or ratsbane; *S. potatōrum*, or clearing-nut; *S. Ignatii*, or St. Ignatius' bean; *S. colubrīna*, or snakewood; *S. toxifĕra*, woorali or curare (q.v.), the poison-plant of Guiana.

Strypa, a battle fought between the Russians and the Austro-Germanic allies from Sept. to Nov., 1915 (see *European War*). The Strypa is one of the main left-bank tributaries of the Dniester, and flows southward through the Podolian Plateau parallel to the Sereth (Siret), Zbrucz, and Zlota Lipa.

Stubbs, William, British historian and divine, born in 1825, died in 1901. He was educated at Ripon Grammar School, whence he proceeded to Oxford University, where he graduated and became a Fellow of Trinity College. In 1848 he was ordained, and became vicar of Navestock, Essex, in 1850. In 1862 he was appointed librarian of Lambeth Palace; in 1866 professor of modern history at Oxford; in 1869 curator of the Bodleian Library; in 1875 rector of Cholderton, Wilts; in 1879 canon residentiary of St. Paul's; in 1884 Bishop of Chester; and in 1888 Bishop of Oxford. He edited many valuable historical works in the Rolls Series, including *Chronicles and Memorials of the reign of Richard I* (1864–5), *Gesta Regis Henrici II* (1867), *Chronicle of Roger Hoveden* (1872–3), *Memorials of St. Dunstan* (1874), and *Opera Radulphi de Diceto* (1876). His chief work is the *Constitutional History of England* (3 vols., 1874–8). He published many other works besides the above, and was a member of various English and foreign learned societies.

Stucco (stuk'kō), a fine plaster, used as a coating for walls, and to give them a finished surface. Stucco for internal decorative purposes is a composition of very fine sand, pulverized marble, and gypsum, mixed with water till it is of a proper consistency. The stucco employed for external purposes is of a coarser kind, and variously prepared, the different sorts being generally distinguished by the name of cements. Some of these take a surface and polish almost equal to that of the finest marble. The third coat of three-coat plaster is termed stucco, consisting of fine lime and sand. There is a species called *bastard stucco*, in which a small portion of hair is used. Stucco was used by the Greeks and by the Romans. It was employed in early Christian art, and became popular during the Renaissance.

Studding-sails, formerly called *scudding-sails*, sails set outside the square sails on booms rigged for that purpose. They are only carried with a fair wind and in fine weather.

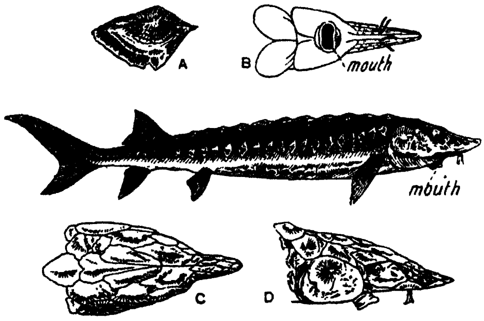
Stuffing-box, the fitting which is inserted on the cylinder end of a steam, pneumatic, or other fluid-using plant to prevent leakage as the piston-rod passes to and fro through it. It consists of a cylindrical box in which a gland is fixed, the packing being inserted between the foot of the box and the gland. A common type of packing is made from hemp. With the advent of high pressures and temperatures the necessity for better types of packing materials has been emphasized and various types of metallic packings have been evolved. These are inserted in the same position as in the older arrangement, but are composed of shaped metallic pieces held together by an enveloping ring and pressed against the piston-rod by small springs. As these packings are usually self-adjusting and have very low frictional coefficients, their use has improved the over-all efficiency of the plant and caused considerable savings to be effected.

Stuhlweissenburg (stöl'vīs-ĕn-bṳr*h*; Hung. *Székes Fejérvár*), a city of Hungary. It was the Roman *Alba Regia*, and was, for five centuries (1027–1527), the crowning- and burial-place of the Hungarian kings. It has a cathedral, built in 1752, a bishop's palace, and a theatre. Pop. 37,000.

Sturdee, Sir Frederick Charles Doveton, first Baronet (of the Falkland Islands), British admiral of the fleet, born 1859. He joined the navy in 1871, commanded the British force in Samoa (1899), was chief of staff Mediterranean Fleet (1905–7), chief of staff Channel Fleet (1907), A.D.C. (1907–8), and commanded the 2nd Cruiser Squadron (1912–3). He is best known, however, as the victor of the great sea-battle of the Falkland Islands (8th Dec., 1914) during the European War, when von Spee's squadron was extirpated. At Jutland, Sturdee commanded the 4th Battle Cruiser Squadron and received the K.C.M.G. He had received the K.C.B. in 1913, and in 1916 was created a baronet, becoming admiral in 1917 and admiral of the fleet in 1921.

From 1918 to 1921 he was commander-in-chief at the Nore. He died in 1925.

Sturgeon, the common name of ganoid fishes of the genera Acipenser and Scaphirhynchus, family Acipenseridæ, the members of which family are all popularly included under the name sturgeon. The general form of the sturgeon is elongated and rather slender, the snout long and pointed in Acipenser, flat and paddle-shaped in Scaphirhynchus; the body is covered with numerous bony plates in longitudinal rows (fused together and extending over the tail in Scaphirhynchus); the exterior portion of the head is also well mailed; the mouth, placed under the snout, is small and funnel-shaped, without teeth, and provided with tentacle-like filaments or barbels. The eyes and nostrils are on the side of the head. On the back is a single dorsal fin, and the tail is forked, but is heterocercal or unequally lobed, and is provided with a row of spines along its upper margin. The species of Acipenser are sea-fish, but ascend large rivers in great abundance, and are the objects of important fisheries. The flesh of most of the species is wholesome and agreeable food; their roe is converted into caviare (see *Caviare*), and their air-bladder affords fine isinglass. The common sturgeon (*Acipenser sturio*) is found off the British coasts, in the North Sea, in the Mediterranean, and in most of the large rivers of Europe. Its flesh is firm and well-flavoured, somewhat resembling veal. The general body colour is yellow; its length is usually 5 or 6 to 8 feet, but it may reach 12 feet. The food consists of molluscs, small crustaceans, and small fishes. When caught in the Thames, within the jurisdiction of the Lord Mayor of London, it may be claimed by that dignitary; formerly it used to be regarded as a *royal* fish reserved for the sovereign. The sterlet (*A. ruthēnus*) is found in the Volga and the Danube. Its flesh is the most delicate, and its roe yields the best caviare. The great or white sturgeon, or hausen (*A. huso*), is found in the Danube, the Volga, and other rivers running into the Black and Caspian Seas. It frequently exceeds 12 and 15 feet in length, and weighs up to 3200 lb. The flesh is not much esteemed, but the finest isinglass is made from its air-bladder. Other species are native to North America. The four species of Scaphirhynchus are known as shovel-nosed sturgeons, which are purely fluviatile. One of these (*S. platyrhynchus*) is North American; the others inhabit the rivers of Central Asia.



Sturgeon (*Acipenser sturio*)

A, Dorsal scute. B, Head from below. C, Head from above. D, Head, side view.

Sturm, J. C. F., French mathematician, born at Geneva 1803, died 1855. In 1829 he discovered a celebrated theorem (Sturm's Theorem) which allows the number of real roots of an equation between given limits to be determined with ease. In 1836 he succeeded Ampère as member of the Academy. From 1840 he was professor of mathematics at the Polytechnic School.

Sturt, Charles, Australian explorer, born 1795, died 1869. He entered the army, and in 1825 was stationed at Sydney, New South Wales, with the rank of captain. In 1828 he led an expedition to explore the interior of Australia, and discovered the Macquarie, Castlereagh, and Darling Rivers. He also explored the Murrumbidgee, and in 1830 discovered the Murray. In 1844 he penetrated to the great barren region nearly in the centre of the continent. He wrote *Two Expeditions into the Interior of South Australia in 1828–31*, and *Narrative of an Expedition into Central Australia in 1844–6.*

Stuttgart, capital of the Republic of Württemberg, Germany, near the left bank of the Neckar. There are two old churches, and the former royal library of 400,000 volumes. Across the river is the town of Cannstatt. Stuttgart is the chief centre in South Germany for the book trade, connected with which are paper-mills, type-foundries, printing-presses, and lithographic establishments. The other leading manufactures include dyes, chemicals, woollen and cotton goods, various fancy articles, jewellery, musical instruments, mathematical and scientific instruments, liqueurs, confectionery, and beer.

Stuttgart dates from 1229, and in 1320 became the residence of the Counts of Württemberg. From 1436 to 1482 it was much improved and enlarged, and has since, with only a short interval, been the capital. Stuttgart was bombed by Allied air-craft during the European War. Pop. (1919), 309,197.

Stuyvesant (stī've-sant), **Peter**, born in Holland in 1592, died in 1672. In 1646 he was appointed Director-General of the Dutch colony of the New Netherlands, a position he held until 1664, when the colony fell into the hands of the English and became known as New York. Stuyvesant went to Holland the next year, but soon returned, and passed the rest of his life at his farm called the Bouwerij, from which the present Bowery in the city of New York has its name.

Stye, or Hordeolum, is a small abscess on the margin of the eyelid, due to suppuration in a hair follicle. During the early stages hot fomentations should be continuously applied, and whenever pus has formed the stye should be opened. Their frequent appearance is often associated with a poor general condition of the patient, and in such cases treatment should be given to improve this. In persistent cases inoculation with staphylococcus vaccine should be undertaken.

Style, in botany, the prolongation of the summit of the ovary which supports the stigma. Sometimes it is entirely wanting, and then the stigma is *sessile*, as in the poppy and tulip. When the ovary is composed of a single carpel, the style is also single, and the number of styles varies according to the number of carpels, though when the carpels are numerous the styles may be united. See *Flower*.

Stylidium, or Candollea, a genus of gamopetalous dicotyledons, herbs or undershrubs, natives chiefly of Australia. *S. adnatum*, which is often grown in greenhouses, has a remarkable pollination mechanism. The floral axis is prolonged into a long, stalk-like column or gynostemium bearing the stigma at its upper end, and, just below it, two sessile anthers. Four lobes of the corolla are normally developed, but the fifth is reduced to a small cushion with a sticky surface. The column performs very active curvatures owing to lop-sided growth. When it comes in contact with the cushion, it is held fast by the sticky secretion for some time after it has started to bend away from it again, so that a state of tension is set up. At this stage a slight touch, e.g. by an insect, sets the column free, and it springs up forcibly, striking the visitor with the stigma and also dusting it with pollen. The action may be repeated several times. In other species the precise methods of temporarily arresting the column vary, though the general principle of the mechanism is the same.

Stylites (stī′līts), or **Pillar Saints** (from the Gr. *stylos*, column; in Lat. *sancti columnares*), a class of Christian saints, who, by way of penance, passed the greater part of their lives on the top of high columns. This method of self-torture was introduced by Simeon the Stylite (St. Simeon Stylītēs), a Syrian monk, although Lucian (*De Dea Syria*, about A.D. 150) speaks of a high column at Hieropolis to the top of which a man ascended twice a year to converse with the gods. Simeon the Stylite lived in the open air near Antioch, on the top of a column 40 cubits high and only 3 feet in diameter at the top. Here he remained for many years, till his death in 459 or 460. It appears, however, that he must have descended at times, since he cured the sick by his touch, and performed sundry other miracles, wrote epistles, and took part in political quarrels. His example was imitated by many persons in Syria and Palestine, and the mania continued until the twelfth century.

Sty′lobate, in architecture, generally, any sort of basement upon which columns are placed to raise them above the level of the ground or floor; but, technically, a continuous unbroken pedestal upon which an entire range of columns stands, contradistinguished from *pedestals*, which are merely detached fragments of a stylobate placed beneath each column.

Styp′tic, a remedy that has the virtue of clotting blood, or of closing the aperture of a wounded vessel. Oak bark decoction, gall-nuts in powder or infusion, matico, and turpentine are styptics derived from the vegetable kingdom; and from the mineral are derived salts of iron, the sulphates of copper and zinc, the acetate of lead, the nitrate of silver, and alum. Among the most valuable of styptics are adrenalin (q.v.) and cotarnine, the latter of which is an oxidation product of the opium base narcotine.

Styr, Austro-German and Russian battles of the European War: (1) 28th Sept., 1915, to 17th Oct., 1915.; (2) June–July, 1916.

Styra′ceæ, or Styraca′ceæ, a small natural order of plants belonging to the polycarpous group of gamopetalous dicotyledons. The species are trees or shrubs with alternate leaves without stipules. The flowers are usually axillary, and are either solitary or clustered, with membranaceous bracts; the fruit is a drupe, the seeds few or solitary. The species are chiefly found in the temperate and tropical parts of North and South America, and also in Asia and Africa. The order is chiefly remarkable for furnishing the benzoin of commerce (see also *Storax*). Some of the species are used for dyeing yellow. The order includes the snowdrop-tree of North America (*Halesia tetraptera*).

Styrax (stī′raks), a genus of plants, nat. ord. Styraceæ, of which it is the type. The species are graceful trees and shrubs, with entire leaves and white or cream-coloured racemose flowers. They are principally natives of America and Asia; one is found in Europe, and one in Africa. *S. officinālis*, also called storax, is a native of Syria, Italy, and the Levant. It was the source of the storax of ancient times. *S. Benzoin* (gum-benjamin tree) is a native of Sumatra and Java. It yields the gum benzoin of commerce. (See *Benzoin*.) The hardy species of Styrax are well adapted for shrubberies, on account of their foliage and handsome flowers.

Styria (Ger. *Steiermark*), a province of the Republic of Austria, formerly a duchy and crown-land. Area, 6317 sq. miles; pop. (1920), 953,864: former area, 8622 sq. miles; pop. (1910), 1,444,157. Under the imperial regime Styria had upper, middle, and lower (or southern) divisions, but Lower Styria, and a part of the middle division south of the Pozruck range and the Mur (roughly 2300 sq. miles), is incorporated in Yugoslavia. There are now sixteen administrative districts, plus Graz, the capital, which is autonomous. Other towns are: Bruck (pop. 8580), Mariazell (2000), Donawitz (15,100), Knittelfeld (11,000), Leoben (11,200), Kapfenberg (13,000), Eggenberg bei Graz (15,600), and Fürstenfeld (6000). The province lies within the Eastern Alps, and produces iron, coal (lignite, Leoben being the metropolis of the mining region), graphite, and salt (at Aussee), with some lead, zinc, copper, talc, manganese, &c. There are large iron-, steel-, and locomotive-works centring on Graz. Old Styria was the richest timber-land of the Dual Monarchy, larch, spruce, beech, oak, and elm being cut, and exported mainly via Trieste. Cattle-raising, apiculture, poultry, viticulture, market-gardening, and the raising of the heavy Norican horses of the Ennsthal are important industries. Styria is served by the trunk-line of railways from Vienna to Trieste via Laibach (see *Systems, Railway*, paragraph 6, section (*j*), and *Trieste*). The line crosses the Semmering Pass, runs down the Mur Thal or valley to Kapfenberg, swings southwards to Graz, and runs on past Spielfeld to Marburg (Yugoslavia). Bruck is the junction for Budapest (see *Systems, Railway*, paragraph 13, section (*d*).

Styx, in Greek and Roman mythology, one of the rivers of the infernal regions. By this the gods swore when they wished to give peculiar sanctity to their oath. Styx was also the name of a rivulet in Arcadia, whose water was considered poisonous.

Suabia, or **Swabia** (Ger. *Schwaben*), an ancient duchy of Germany, originally Alemannia, the home of the Alemanni, but overrun by the Suevi, and subsequently known as Suevia or Schwabenland. It existed as a duchy from the tenth to the middle of the thirteenth century, corresponding generally to Württemberg, Baden, parts of Bavaria, Liechtenstein, and Hohenzollern, and the union of its towns (1376) gave rise to the Suabian League. Modern Suabia is a division (*Regierungsbezirke*) of the Bavarian Republic. Area, 3934 sq. miles; pop. 835,700; capital, Augsburg.

Suâ'kin, a port of the Anglo-Egyptian Sudan, on the Red Sea. The main part of the town occupies a coralline island in the Red Sea, and the mainland portion (Al Kaf) is fortified. Pop. 10,000. See *Port Sudan*.

Sua'rez, Francisco, Spanish theologian, born 1548, died 1617. Joining the Jesuits (1564), he was successively professor of theology at Valladolid, Rome, Alcalá, and Salamanca. Philip II appointed him professor of divinity at Coimbra (1597), a position he held until his death.

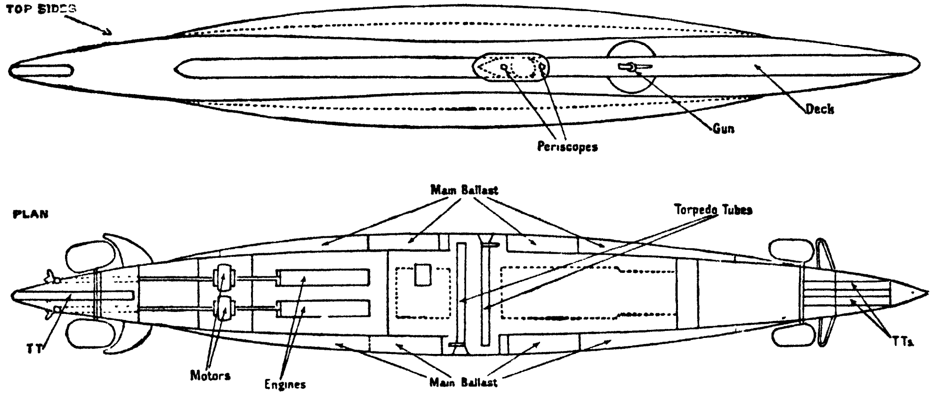
Sub'altern, a subordinate; most commonly used to designate military officers under the rank of captain. In modern times the term subaltern officers denotes lieutenants and second-lieutenants, the latter being the present-day titles of the former cornets (of horse) and ensigns (of foot).

Subconsciousness, a psychological term applied in a variety of ways by different psychologists. It principally means a fainter or obscurer degree of consciousness, dim and partial, which gradually gives way to a state of non-consciousness. There is a subconsciousness of impressions and a subconsciousness of ideas. The term is further applied to those activities of the mind which, lying below the level of clear consciousness, or being unaccompanied by consciousness, cannot be submitted to introspection. To such activities of the unconscious belong many of our unreasoned sentiments and unreflective movements, and also the cases witnessed in telepathy, somnambulism, clairvoyance, and hysteria, and many other psychical phenomena called abnormal. See *Psychotherapy and Psychoanalysis*. — BIBLIOGRAPHY: J. Ward, *Psychological Principles*; J. R. Angell, *Psychology*; J. Jastrow, *The Subconscious*; S. Freud, *The Psychopathology of Everyday Life*.

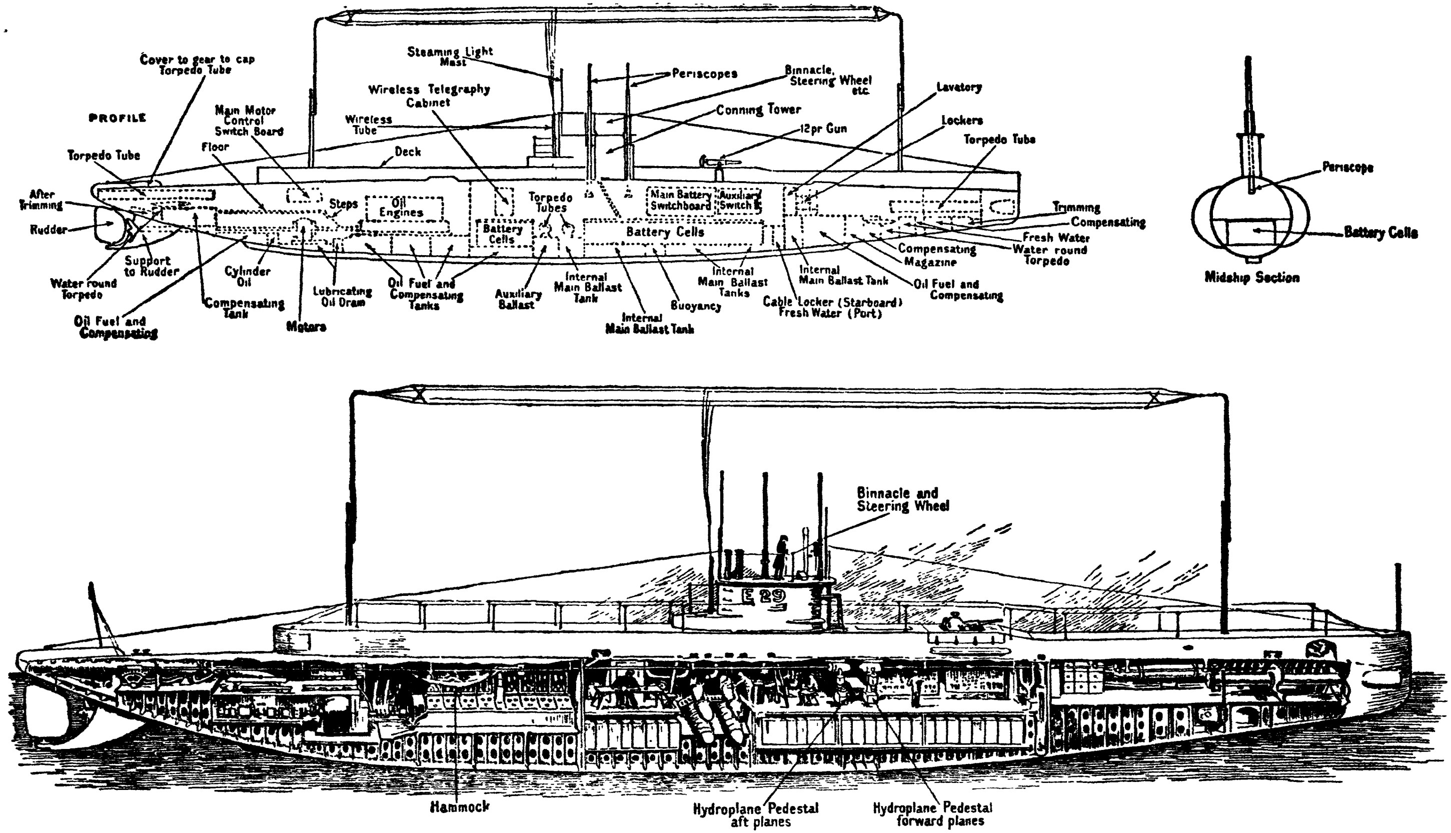
Subia'co (ancient, **Sablaqueum**), a town of Italy, in the province of Rome, on the Anio, 1340 feet above sea-level. There are ironworks and paper-mills. Pop. 8215.

Sublimation, the conversion of a solid directly into a vapour or gas when heated, and the conversion back into the solid on cooling, without, in either case, the intermediate formation of a liquid phase. Sublimation bears the same relation to a solid that distillation does to a liquid. It is made use of for purifying substances, as in this way a volatile solid may be separated from a non-volatile one. The solid which is deposited as the vapour cools is termed the *sublimate*; when this is in a very fine state of division, it is sometimes spoken of as *flowers*, e.g. the *flowers* of sulphur. Camphor, ammonium chloride, mercuric chloride, and various compounds are purified by this method, and are deposited as hard, compact masses.

Submarines. Submarine boats, driven by hand-power, were constructed by Bushnell, an American, in 1775, and by Robert Fulton (q.v.), about 1800. A mechanically driven submarine was built in France in 1863; it was designed by C. Brun, was 146 feet long and 12 feet in diameter, and was driven by a compressed-air engine. In 1877 an experimental boat was built by J. P. Holland, and in 1883 Nordenfeldt built a submarine at Stockholm. Speaking broadly, the modern submarine may be considered as due to these two inventors. In 1887 Holland and Nordenfeldt submitted competing designs to the United States Government. Holland's was the design accepted. It differed from Nordenfeldt's in being, as most modern boats are, a diving rather than a sinking device. In the earliest 'A-type' boats of the British navy, the hull was constructed of ½-inch steel plate. A cylindrical tower, known as the conning-tower, is riveted on the top of the hull amidships. The conning-tower is provided with a lid about 18 inches in diameter, which opens outwards. A certain amount of air is imprisoned in the hull, and this is the air the crew breathes when the vessel is submerged. The machinery inside the vessel is extremely complex, and consists essentially of the following plant: (1) a petrol- or oil-engine; (2) an electric machine, which can be used either for propulsion or as a dynamo; (3) an electric storage battery; (4) a powerful air-compressing installation; (5) storage bottles for storing compressed air; (6) machinery for controlling the hydroplanes, which are the fin-like structures that project from the sides of the vessel and control its depth; and (7) the fighting equipment, namely, torpedoes and tubes. The process of submerging is as follows. Between the bottom of the hull and the deck is a series of tanks into which sea-water can be allowed to flow by opening sea-cocks. These tanks are closed ones, so that, as the water enters them, the air above the water must be allowed to pass out into the body of the vessel through vent-pipes. As the first step before submerging, the crew are ordered to their 'stations', i.e. each man 'stands by' the particular piece of mechanism or the valve that it is his duty to control. Prior to diving, the captain usually has a final look round, and closes the conning-tower hatch himself on descending into the boat. The order is then given to open certain sea- and vent-cocks, with the result that the selected tanks are filled with water. The boat now retains a small amount of positive buoyancy, i.e. it is just about to submerge. The final adjustment of buoyancy is more carefully made, so that the boat finally has a very slight amount of buoyancy before the sea-cocks and vent-cocks are finally closed. Meantime the main engine-coupling has been disconnected, and the electric motor switched in. The coxswain adjusts the tilt of the hydroplanes, so that the influence of the sea on them overcomes the slight buoyancy of the boat and submerges it to the depth required. The boat is kept running at a constant depth of submergence by altering the angle of the hydroplanes, just as a rider controls a bicycle. In attacking a ship, one of the greatest dangers that the submarine must guard against is the 'periscope wake'. The officer of the submarine will keep at a depth of, say, some 30 feet and take a peep at the quarry from time to time. He will take every precaution to avoiding changing his depth in such a way as to oscillate or break surface. Changes of density of the sea-water, for instance, such as may occur in an estuary, are particularly disconcerting. Having discharged its torpedo by means of compressed air in the usual way, and made itself as much of a nuisance as it can to the enemy, the submarine leaves the scene of action as quietly as possible. The problem is then to rise to the surface, for the



Top Sides View and Plan of Interior of 'E' Class Submarine



BRITISH SUBMARINE, 'E' CLASS

A diagrammatic exterior view and midship section are shown above; below, a longitudinal section operation of attack may have kept the ship submerged for any time up to eight hours or so. Rising is effected by compressed air. The vent-cocks of the tanks are closed and the sea-cocks opened. Compressed air is allowed to enter the tanks, whereby the water is blown into the sea. The sea-cocks are then closed. In this way a definite positive buoyancy is regained and the boat comes to the surface. The main engine is now coupled up to the propeller, and the boat is driven along the surface by means of petrol or oil. The motor is now run as a dynamo, and the battery is recharged. To replenish the store of compressed air, which is used in diving, torpedo-firing, and rising, the air-compressors are set to work and the air-bottles recharged. The submarine is given a general clean up, adjustments made to the batteries or machinery, and so on. After a few hours' run on the surface, the battery and air-bottles may be fully recharged, and the submarine is ready to make its next attack.

Submerged Forests, a term applied to beds of peat, with roots, stems, and branches of trees, &c., occupying the sites on which they grew, but which by change of level are now submerged by the sea. They belong to the recent or Quaternary period of geologists, and in the British Isles succeed the glacial deposits.

Subornation of Perjury. See *Perjury.*

Subpœ'na, in law, is a writ commanding a witness to appear in court under a penalty *(sub pœna)*, which in England is of £100. When he is required to bring books or papers in his possession, a clause is inserted to that effect, and the writ is then called a *subpœna duces tecum* (' bring with you under penalty '). A witness is allowed his travelling expenses.

Substance (Lat. *sub*, under; *stare*, to stand), in philosophy, that which exists independently and unchangeably, as distinguished from *accident*, which denotes the changeable phenomena in substance. Substance itself is the essence which is capable of these phenomena, and in spite of any changes in the phenomena remains the same. The fundamental doctrine of Descartes' philosophical system was the essential difference between mind or thinking substance and matter or extended substance. According to Spinoza there is only one absolute, infinite substance, all beings being only ' modes ' of it. Leibnitz calls substance that which contains in itself the cause of its changes. In natural science and in common life, substance is used to designate material things, especially simple inorganic bodies, and the fundamental constituents of organic bodies.

Subula'ria, a genus of plants, nat. ord. Cruciferæ, found in the gravelly bottoms of lakes, usually in shallow water, in North and Central Europe, North Asia, and the Northern United States. *S. aquatica*, or awlwort, the only species, consists merely of a tuft of white fibrous roots, narrow awl-shaped leaves, and a leafless stalk, bearing a few small white flowers. It is indigenous to Scotland and the north of England and Ireland.

Succession Duty is a duty levied on the interest to which a person succeeds on a death in respect (*a*) of real (heritable) property in the United Kingdom; (*b*) of charges on real property made by the deceased in exercise of any power or otherwise, and on the proceeds of sale of real property directed to be sold, or sold under a power, in the will of the deceased; and (*c*) of personal (moveable) property not liable to legacy duty, the deceased owner thereof having been domiciled in the United Kingdom. The rates of succession duty and the rules governing its application in respect of relationship and value are the same generally as in the case of legacy duty (q.v.). Unlike that duty, however, succession duty need not be paid in one sum, but may be extended over a period of eight years, and paid in yearly or half-yearly instalments, with interest at the rate of 4 per cent per annum on the balance outstanding from time to time from one year after the opening of the succession. The duty is a first charge on the interest of the successor, on whom is the obligation to declare his accountability.

Succession, Wars of. Dynastic disputes have been responsible for many military conflicts in European history, and in a large proportion of instances the struggle was not purely a civil war, but was also an opportunity for foreign intervention. The Scottish War of Independence was the result of a disputed succession, and in the Hundred Years' War a dynastic controversy afforded the formal excuse for English efforts to conquer France. The term ' Wars of Succession ' is, however, generally employed to describe four eighteenth-century conflicts—the Wars of the Spanish, Polish, Austrian, and Bavarian Successions.

Spanish.—The War of the Spanish Succession (1702–13) was a result of the enormous extent of the possessions belonging to the Spanish Crown, and of the determination of Austria, Britain, and other Powers to check the aggrandizement of France. Before the death of the childless Spanish king, Charles II, in 1700, efforts were made to arrive at a peaceful settlement by means of Partition Treaties, dividing the heritage among the three claimants—Philip, Duke of Anjou (a grandson of Louis XIV); Joseph, Electoral Prince of Bavaria; and the Archduke Charles of Austria. Philip was a grandson of the elder sister, and Joseph of the younger sister, of Charles II, but both these princesses, on making foreign marriages, had renounced their rights of succession to the Spanish throne; the Archduke Charles was the grandson of an aunt of Charles II who had made no renunciation. The death of Joseph in 1699 nullified an agreement among the Powers that he should succeed to Spain, the Spanish Netherlands, and the colonies, while Philip was to have Naples and Sicily, and Charles, Milan. A second agreement, to which Louis XIV assented, gave to Charles all the Spanish possessions except Milan, which it was agreed that Philip might exchange for Lorraine. But when Charles II left all his possessions to Philip, the old French king accepted the inheritance for his grandson, and the Powers began to prepare for war, which broke out in 1702. The Grand Alliance, of which the chief members were Great Britain, Austria, and Holland, was successful in the war, largely owing to the military genius of the Duke of Marlborough; but the allies were jealous of each other, and the persistence shown by France in continuing a hopeless struggle was rewarded by better terms in 1713 than could have been obtained earlier. The whole situation was changed in 1711 by the succession of the Archduke Charles to the Austrian crown as the Emperor Charles VI. This event made him, from the British standpoint, a less desirable candidate for the Spanish throne than Philip of Anjou, for he would unite Austria and Spain, whereas Philip was not the heir to the French throne. This consideration explains the readiness of Great Britain, as reflected in the Treaty of Utrecht, to acknowledge Philip V King of Spain, on condition that the French and Spanish Crowns should never be united. Austria, which came to terms with France in 1714, received Naples, Milan, Sardinia, and the Spanish Netherlands.

Polish.—The War of the Polish Succession (1733–5) originated in the determination of France to place Stanislaus Leszcynski, father-in-law of Louis XV, on the elective throne of Poland as part of a forward foreign policy which included an alliance with Spain against Austria. Stanislaus was duly elected, but was soon driven out of Poland by Russians and Saxons, who supported his rival, Augustus of Saxony. The war ended in the establishment of Augustus on the throne.

Austrian.—The War of the Austrian Succession (1740–8) was fought over the claim of Maria Theresa to succeed to the Habsburg dominions which had belonged to her father, the Emperor Charles VI. By a document known as the Pragmatic Sanction, Charles had obtained a recognition of his daughter's right, and on his death she was accepted as their ruler by the people of Austria, Hungary, and Bohemia. But Frederick II of Prussia seized Silesia, an appanage of the Bohemian Crown, and (1742) Maria Theresa consented to a surrender of the greater part of the province in order to prevent an attack by France and Prussia upon the Austrian Netherlands. She had also a rival in the new emperor, the Elector of Bavaria, who was married to the daughter of an elder brother of Charles VI, and claimed that his wife had a better title to the Habsburg territories than her cousin. Spain, in the hope of securing Austrian territory in Italy, joined France and Bavaria. Great Britain, under George II, intervened on behalf of Austria, and by the Treaty of Worms (1743) Britain, Austria, Holland, Sardinia, and Saxony combined to maintain the Pragmatic Sanction. This treaty did not recognize the cession of Silesia to Prussia, and Frederick II joined Spain, France, and Bavaria. The war thus became a general European conflict. In 1745 the Emperor Charles VII (Elector of Bavaria) died, and Maria Theresa secured both the adhesion of Bavaria to her cause and the election of her husband as the Emperor Francis I. The struggle continued, with variations both of fortune and of alliances, until 1748, when, by the Treaty of Aix-la-Chapelle, Maria Theresa retained her inheritance, with the exception of Prussian Silesia.

Bavarian.—The War of the Bavarian Succession (1778–9) was connected with Austrian ambitions. On the death of the childless Elector Maximilian Joseph, the Emperor Joseph II wished to obtain the succession, to the detriment of the Elector Palatine, Charles Theodore, and Austrian troops invaded Bavaria. Charles Theodore acquiesced, but his heir, the Duke of Zweibrücken appealed to France and Prussia; there were some hostilities, but the Austrians did not persist, and the succession of Charles Theodore was recognized by the Peace of Teschen (1779).—Bibliography: W. E. H. Lecky, *History of England in the 18th Century*; *Cambridge Modern History* (vols. v and vi).

Succinic Acid ($CO_2H{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2H$), a dibasic acid obtained originally by the dry distillation of amber, now often prepared synthetically by fermenting a solution of ammonium tartrate. It forms large colourless prisms of melting-point 185° C. The acid is used in analysis and in separation of some of the rare earths.

Succulent Plants, those xerophytes (q.v.) in which the leaves or stems or both are fleshy, owing to the presence of a large proportion of water-storing cells, as cacti, many Euphorbias, Agave, glasswort, &c.

Suchet (sů-shā), Louis Gabriel, Duc d'Albufera da Valencia and Maréchal de France, French soldier, one of the most brilliant of Napoleonic commanders, born 1770, died 1826. The son of a silk manufacturer, he took part in the siege of

Toulon (1793) and captured General O'Hara. He served successively under Joubert (Tirol campaign, 1797), Brune (1797–8, to whom he became Chief of Staff), Joubert (1799, as general of division and Chief of Staff), and Masséna (1800, second in command). In the 1805–6 campaigns he gained a great reputation, and married a niece of Joseph Bonaparte's wife. In Spain he extirpated the armies of Blake and O'Donnell, and (1812) was raised to the peerage. Louis XVIII made him a peer of France at the Restoration, but by his adherence to Napoleon during the Hundred Days, when he commanded one of the armies of the east, he lost honour and titles.

Sucker, or **Sucking-fish**, a name applied popularly to the Remora (q.v.), to the lump-sucker (q.v.), and also to the fishes belonging to the teleostean genus Lipăris, which is nearly allied to the lump-suckers. The best-known forms are Montague's sucker (*Lipăris montagui*) and the common sucker or sea-snail (*L. vulgāris*), which adhere to stones and other fixed objects by means of their united ventral fins. They are small fishes, 3 or 4 inches long.

Suckling, Sir John, English poet, courtier, and dramatist, was born in 1609, and died in 1642. His father was a Privy Councillor and Secretary of State. He was educated at Trinity College, Cambridge, where he did not graduate. At the age of eighteen he inherited rich estates in Suffolk, Lincolnshire, and Middlesex. He travelled in France and Italy, and was knighted in 1630, on his return. He became a leading member of the gay court circle. In 1631 he joined the Marquess of Hamilton's force which served under Gustavus Adolphus. On the outbreak of the Scottish campaign of 1639 he raised and elaborately equipped a troop of horse for the king. Subsequently he was implicated in what was known as the 'first army plot', and fled to France, where he is believed to have committed suicide at the age of thirty-three.

The writing of verses and plays was merely Suckling's relaxation; soldiering was his avocation; his vocation was playing cribbage (which he invented) and bowls. His three plays, *Aglaura*, *The Goblins*, and *Brennoralt*, are chiefly memorable for their elaborate mounting, which resembled that of masques, and for their lyrics. Suckling is less remarkable for his own plays than for being an ardent admirer of Shakespeare. In the best extant portrait of him he is represented as holding a copy of the First Folio. In his songs and lighter pieces, for which he is chiefly famous, he definitely broke away from the Jonsonian tradition. In the best of his pieces, *A Ballad upon a Wedding*, instead of following wearily in the wake of Catullus, he adopted a new style of his own. His best-known lyrics are "Out upon it! I have loved" and "Why so pale and wan, fond lover?". Among his other works there is, oddly enough, a tract against Socinianism entitled *An Account of Religion by Reason*. Suckling's lyrics are distinguished for their gaiety, ease, and spontaneity, but do not display imagination of a high order.

Sucrate, a compound of a sugar, e.g. grape-sugar or cane-sugar, with such oxides as those of calcium, barium, and strontium. Examples are: $C_{12}H_{22}O_{11} + CaO + 2H_2O$; $C_{12}H_{22}O_{11} + 2CaO$.

Sucre. See *Chuquisaca.*

Sucre (sō'krā), Antonio José de, Venezuelan soldier, born 1793, died 1830. In 1811 he took part (under Bolivar) in the rising against Spain, won the battles of (1812) Pinchincha (which freed Ecuador) and (1824) Ayacucho. Ayacucho liberated Upper Peru, which became the Republic of Bolivia, with Sucre as life President (1826). He was driven out by an insurrection (1828), but reinstated himself at the head of a Colombian army (battle of Giron, Feb., 1829), and was later assassinated.

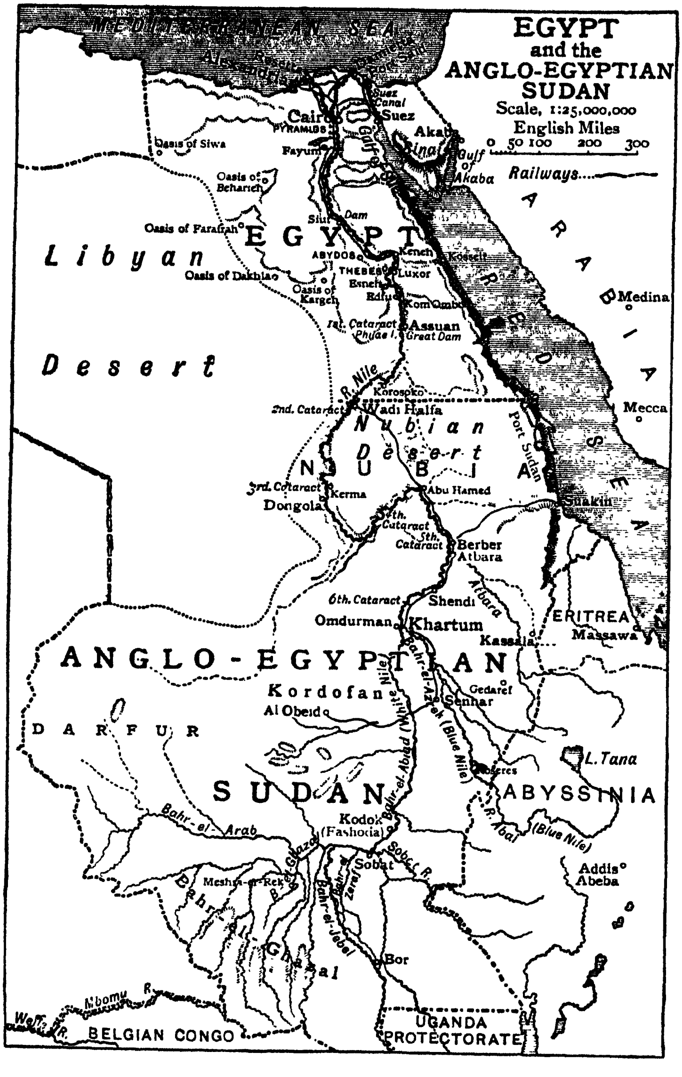
Sucto'ria ('sucking animals'), also called Discophora and Hirudinea, an order of Annelida or segmented worms, represented by the leeches (q.v.) and their allies.

Sudan, The, a geographical region of Northern Africa, extending between the Atlantic and the Nile Valley, and forming an area of transition between the humid forests of Equatoria and the arid wastes of the Sahara. Politically it is partitioned between France and Britain, the colonies of the former nation comprising: Senegal, Guinea, Ivory Coast, Dahomey, Mauritania, Upper Volta, and French Sudan. British possessions are: Sierra Leone, Gambia, Gold Coast, and Nigeria. Liberia is independent, and there is a Portuguese colony of Guinea. The term Sudan, however, is applied officially to the Anglo-Egyptian Sudan. Togoland (q.v.) was partitioned between Great Britain and France after the European War.

Sudan, The, or **Anglo-Egyptian Sudan** (Ar. *Blad-es-Sudan*, land of the blacks), a country of North-Eastern Africa, extending between Egypt (south of 22° N. lat.) and Uganda, and between the Red Sea and Wadai (Central Africa). Area, 1,014,000 sq. miles. The population, half of which is negroid and is found in the equatorial region, is roughly 3,000,000.

Physiography.—The Sudan is low and flat in the centre and north, mountainous in the east, hilly towards the west, and elevated in the south-west, between the Nile and Congo basins. West of the Nile are the Libyan and Bayuda Deserts; east of the Nile is the Nubian Desert. Oases and wells include: Selima, Lagia (Al-Agia), and Al-Hafra. The Nile, however, is the greatest physical feature, with its tributaries (right bank) Sobat, Blue Nile, Atbara;

and (left bank) the Bahr al-Ghazal, with its affluents the Bahr al-Arab, Jur, Bahr Tonj, and Lol. The Sudan occupies the middle region of the Nile basin. *Climate.*—Lying within the tropical zone, the whole region is climatically hot, but with variations according to locality, in view of the size of the country. The south and easterly parts (towards the Abyssinian plateau) are regions of great rainfall; in the north there is comparatively little rain, and where there is none the country is desert. The north is hot in summer, dry and cool in winter, and generally healthy; the east is cooler, but decidedly unhealthy in the river valleys; the south is hot, humid, and unhealthy. The negro people are found among the swamps, tropical forests, and savannahs of the south, and in the central and northern areas and the cultivable lands are the Arabs.



Communications. — There are two trunk lines of railway: (1) the Halfa-Khartum and (2) the Red Sea. The first is connected by boat with Shellâl (Aswân), the terminus of the railway from Alexandria (Egypt) via Cairo, and from Halfa it leaves the Nile, strikes across the desert to Abû-Hamed, whence it follows the right bank of the Nile to Khartum; length, 575 miles. The Khartum extension runs beside the Blue Nile and across the Gezira to Sennar, whence it strikes west across the White Nile to Al-Obeïd; length, 350 miles. Atbara is the junction for (2), running to Port Sudan (q.v.) and Suakin (497 miles); and from Abû-Hamed a line runs to Karima (188 miles). Steamer traffic is maintained on the White Nile as far south as Lado and Gondokoro (Uganda); but in the Upper Nile and the Bahr-al-Ghazal sudd-cutters and dredgers are necessary to cope with the *sudd* or masses of water-weeds that choke the watercourses. Of the six cataracts of the Nile, five of them impede river traffic in the great meander between Khartum and Halfa.

Production.—Sudan leads the world in the production of gum-arabic (mainly from Kordofan) and ivory. Agriculture is confined, north of Khartum, to the Nile Valley, and is assisted by irrigation. Cotton (Egyptian) has been introduced in the Tokar district (Red Sea Province) and in the Nile Valley, and the grant of an Imperial subsidy to this industry in 1922 provoked much criticism in Great Britain. Durra and dukhn (both millets) are the chief crops; sesame, dates, senna leaves and pods, hides, skins, and gold are other products.

Towns.—Khartum is the capital, but Omdurman (the Khalifa's capital) is larger. Khartum North, Halfa, Merowe, Al-Damer, Atbara, Port Sudan, Suakin, Kassala, Al-Dueim, Kosti, Al-Obeïd, Wad Medani, Nahud, and Al-Fasher (the former capital of Darfur, which was annexed in 1916; see *Senussi*) are the chief places.

Social Conditions: Religion.—All the Arab tribes profess Islam; the negro tribes are mainly pagan, although some have been converted to Mahommedanism. *Education.*—There is a central education authority which controls *kuttabs* or elementary vernacular schools (about eighty in number) for boys between seven and ten years of age. At Khartum, Omdurman, Al-Obeïd, and elsewhere there are primary schools in which English is taught side by side with Arabic and mathematics. Gordon College, Khartum, can be entered direct from the primary schools, and here technical subjects are taught and the prospective *qadis* (native magistrates) and teachers are instructed. An agricultural research department, geological survey, and the Wellcome Tropical Research Laboratory are maintained.

Government.—There are fifteen provinces (*mudirias*) each under a Governor (*mudir*), who is a British officer of the Egyptian army. Provinces are subdivided into districts, and over one or more a British Inspector is appointed, who is assisted by Egyptians and Sudanese. Laws, &c., are promulgated by the Governor-General in Council. The Anglo-Egyptian Sudan is administered under a condominium in virtue of an Anglo-Egyptian Convention, completed at Cairo on 19th Jan., 1899. British and Egyptian flags are flown side by side, and no customs duties are levied on Egyptian commerce. Slavery is absolutely prohibited, and the import of liquor and weapons is under strict control. The exact status of the Sudan was made a subject for future consideration on the recognition by Britain of Egyptian national aspirations and the elevation of King Fuad to the Egyptian throne. See *Egypt* for résumé of history.

BIBLIOGRAPHY: Slatin Pasha, *Fire and Sword in the Sudan*; W. S. Churchill, *The River War*; P. F. Martin, *The Sudan in Evolution*; handbooks published by H.M. Government relating to the Sudan generally, postal services, forestry, travel and sport, and traffic, &c.

Sudbury, a municipal borough and market town of Suffolk, England, on the Stour. It was known to the Saxons as *Sudberi* (*Suthberie*), was one of the first towns selected by Edward III for the settlement of Flemings and the establishment of woollen manufactures, and was made a borough by Queen Elizabeth. The grammar-school was founded in 1491. Manufactures include flour, coco-nut matting, and malt. Pop. 7050.

Sudbury, a county town of Ontario, Canada; served by the Canadian Pacific, National (two lines), and Algoma East Railways. It is the centre of the nickel region (sulphides), from which 80 per cent of the world's supply is derived. There are large smelters, creamery, foundry, machine-shops, &c. A Government school of mines is carried on in connection with the local technical school. Pop. 8800.

Sudermann, Hermann, German novelist and dramatist, born 1857. He won European fame in 1888 with his first play, *Die Ehre*, and his novel *Frau Sorge* (English translation, Dame Care). Among his other works are: the novels *Der Katzensteg* (English translation, Regina) and *Das hohe Lied*, and the dramas *Heimat* (English translation, Magda), *Es lebe das Leben* (The Joy of Living), and *Der Gute Ruf*.

Sudetengebirge (sö-dā'tn-ge-bir-gė), or **Sudetic Mountains**, a mountain range of Central Europe, extending east from the Elbe valley to the Oder and continued by the Carpathians. Schneekoppe in Riesengebirge (q.v.) is highest (5260 ft.).

Sudorifics are measures used in medicine to produce profuse sweating. The glands of the skin are of two kinds—the sweat-glands, and glands which, from the greasy nature of their secretion, are termed *sebaceous*. These lubricate the hairs covering the body, while the sweat-glands perform a dual function in the excretion of waste product and, since evaporation from any surface involves a lowering of its temperature, the regulation of body heat. Normally about a quart (1000 c. c.) of sweat is poured out daily, containing from 4 to 5 per cent of the total nitrogen excreted from the body; but this amount may be very considerably increased if the action of the kidneys is interfered with. A nervous mechanism, capable of direct and reflex stimulation, controls sweat secretion, and certain drugs stimulate the glands themselves. In disease a knowledge of these facts is made use of to reduce fever, or to expedite the excretion of toxic bodies from the blood, whether they are normal physiological products which the kidneys fail to eliminate, or poisons generated by micro-organisms. Antimony and ipecacuanha stimulate sweating indirectly through the stomach. Hot, spiced drinks have the same effect, by acting upon the nerve-endings of the mouth and throat, as well as upon those of the stomach. Ammonium salts, camphor, strychnine, pilocarpine, physostigmine, and nicotine stimulate the central nervous mechanism. All these drugs and some others are used as sudorifics, while not the least valuable method of securing sweating is the application of heat, moist or dry, which, by dilating the vessels, facilitates diaphoresis.

Sue (sü), Marie-Joseph-Eugène, French novelist, born at Paris in 1804, died in 1857. He became a surgeon in the army, and served in Spain in 1823. In 1825 he joined the naval service, and was present at the battle of Navarino in 1827. On his father's death in 1829 he inherited an immense fortune, and, having abandoned his profession, he devoted himself to literary composition. His first work was a sea novel entitled *Kernock le Pirate*, which was quickly followed by *Plick et Plock*, *Atar-Gull*, *La Salamandre*, and *La Vigie de Koatven*. He now entered the departments both of historical fiction and the novel of real life. Of the former description were *Latreaumont*, *Jean Cavalier*, and *Le Commandeur*; of the latter were *Arthur*, *L'Hôtel Lambert*, and *Mathilde*. But his most famous works are *Les Mystères de Paris* and *Le Juif Errant*. His later novels are *L'Enfant Trouvé*, *Les Sept Péchés Capitaux*, and *Les Mystères du Peuple*. In 1850 he was elected to the Constituent Assembly, and sat as an advanced radical. After the *coup d'état* by Napoleon III in 1851 he left Paris and retired to Annecy.

Sueca (sụ-ā'kȧ), a town of Valencia, Southern Spain, on the Jucar. It is an agricultural centre. Pop. 17,000.

Suet, the fatty tissue situated about the loins and kidneys of certain domestic animals, especially the ox and sheep, and which is harder and less fusible than the fat from other parts of the same animals. Beef-suet is much used for culinary purposes, and purified mutton-suet forms an ingredient in ointments, cerates, and plasters.

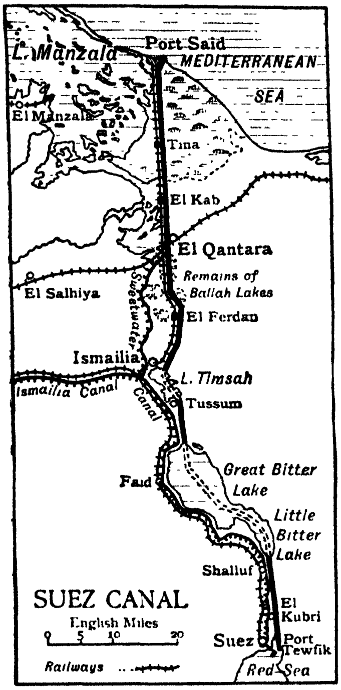
Sueto'nius (Gaius Suetonius Tranquillus), Roman historian or anecdotist, lived during the end of the first and the first half of the second century A.D. Very little is known about his life. He was a friend of Pliny the Younger, and began life as an advocate. He became *magister epistolarum* or private secretary to the Emperor Hadrian; this position probably gave him access to many official and private documents. He was deprived of his office for behaving contrary to court etiquette, and devoted himself to literature. He was a voluminous writer; his works, which were almost encyclopedic in their range, dealt with such subjects as Greek games, Roman shows, shorthand, costume, words of ill-omen, and pedigrees. All these works are lost; short lives of Terence, Horace, Lucan, and Pliny the Elder are preserved, as are fragments of his books *On Famous Schoolmasters* and *On Famous Professors*. His reputation, however, rests upon his *Lives of the Twelve Cæsars*, or lives of the twelve emperors from Julius Cæsar to Domitian.

If it be true that the style is the man, it might be argued that Suetonius never existed. He has no style; he sets down his extremely interesting material just as it occurs to him. His prose is a pleasant contrast to the florid prose of Seneca, but it is not the work of a literary artist. He has, however, many good qualities. He does not point a moral any more than he adorns his tale; he lets the facts tell their own story. He is accurate; his work shows considerable research and complete honesty. He compresses a great deal of information into a very small compass. But he ranks as a chronicler rather than as an historian; the great value of his work is due to the number of personal anecdotes about the emperors which he has preserved.—Cf. J. C. Rolfe, *Suetonius* (text and translation, Loeb Classical Library).

Sue'vi, the general name of a number of united tribes who, before the Christian era, inhabited parts of Germany. The confederation included the Marcomanni and the Semnones, the former inhabiting what is now Bohemia, and the latter the present Lusatia and Brandenburg. The Suevi of Cæsar lived between the Rhine and the Weser. In the great migration of the northern nations the Suevi joined the Alans, entered Gaul, and in 409 Spain. After the Vandals had gone to Africa the Suevi spread as far as Portugal. They were overcome and absorbed by the Visigoths in 586, but the name still lives in *Suabia* (q.v.).

Su'ez, a town of Egypt, on the Gulf of Suez, the Red Sea terminus of the Suez Canal. Previous to the construction of the Suez Canal, and the freshwater Ismailia Canal from the Nile, it was a miserable place. Pop. 30,996.

Suez Canal, the great ship-canal without locks connecting the Mediterranean with the Red Sea; running from Port Said on the former to Suez on the latter, a distance of nearly 100 miles. According to Herodotus, a large canal from the Red Sea to the Nile was constructed about 600 B.C. This canal, which seems never to have been of much use, was finally blocked up about A.D. 767. Napoleon I had conceived the idea of making a ship-canal across the Isthmus of Suez. In 1854 the French engineer M. Ferdinand de Lesseps obtained a concession for that purpose, and in 1858 was able to form a company. Operations were begun on the 25th April, 1859, and on the 17th Nov., 1869, the canal was opened. There were 75 miles of actual excavation, the remaining 25 miles being through shallow lakes (Menzaleh, Timsah, Bitter Lakes), which usually required deepening. For about four-fifths of its length it was originally 327 feet wide at the surface of the water, 72 feet at the bottom, and 26 feet deep; for the remainder only 196 feet wide at the top, the other dimensions being the same; but the increase of traffic necessitated widening and deepening. A canal (Ismailia Canal) was also constructed for bringing fresh water from the Nile at a point near Cairo. This canal reaches the salt-water canal at Ismailia, and then runs almost parallel to the ship-canal to Suez. It is used for navigation as well as for domestic purposes and irrigation. In Nov., 1875, the British Government bought from the Viceroy of Egypt his interest in the canal, consisting of 176,602 shares, for the sum of £4,000,000. The shipping passing through the canal has steadily increased, and in 1920 amounted to 16,892,244 tons, carrying 500,000 passengers, while the receipts were £10,698,427. Of the tonnage passing through in 1920, 10,452,055 belonged to Britain. Navigation at night by aid of electric light began in 1887. The distance between London and Bombay by the old route round the Cape is about 11,202 miles; by the canal route, 6332 miles. See *European War (Palestine Campaign)*.



Suffolk (suf'ok; literally south-folk), a maritime county of England, bounded by the North Sea, Essex, Norfolk, and Cambridgeshire. It has a coast-line of about 62 miles, and an area of 1482 sq. miles. Among rivers are: the Lark, a tributary of the Great Ouse; the Stour, which passes Sudbury and flows into the sea at Harwich; the Gipping, which runs from Stowmarket to Ipswich, and thence, under the name of the Orwell, to Harwich, where it unites with the Stour; the Deben, the Alde, and the Blythe. Suffolk is for the most part flat, and the soil on the north-western and eastern borders of the county is very sandy. The sea has made great encroachments on the Suffolk coasts, and has partially destroyed some once considerable towns, as Dunwich and Aldeburgh. Agriculture is progressive. The seaports export corn and malt, and herring, mackerel, and oyster fisheries are carried on. Ipswich is the county town, the next in importance being Lowestoft. Pop. (1921), 399,988. —Cf. W. Page (editor), *Victoria Histories of the Counties of England: Suffolk.*

Suffrage, the right to vote for any purpose, but more especially the right of a person to vote in the election of his political representative. Many writers advocate the universal extension of this right, but in Britain and most European countries it is limited by a household or other qualification. It is generally held by leading politicians that the extension of the suffrage should proceed gradually with the advance of education. The Representation of the People Act (q.v.), 1918, conceded a very wide measure of adult suffrage in Britain, the qualifications being modified and the franchise extended to women.

Sufism, or **Soofeeism,** the pantheistic mysticism and asceticism of Islam, which reached its highest stage of development in the fourth century A.H. (i.e. after *Hijra*: the eleventh century of the Christian era). After the initial period of Muslim conquest, with its attendant evils of accumulated wealth and luxurious taste, a movement back to a purer religious code became manifest, and secured many adherents, who were conspicuous by their excessive abstinence and fanatical devotion no less than by their exceptional efficiency as preachers and reformers. The actual date of introduction of a pantheistic dogma is unknown, but constant meditation on the text of the *Koran*, combined with features of asceticism, and the revivalist spirit, has resulted in the evolution of a theology which has little in common with the message of that work. Modern Sufic orders are exclusive, and a novitiate is necessary; there is a definite ritual, and oratories, meeting-houses, and hostels bind together the members with religious ties in such a manner as to render the corporate orders of considerable use as political organizations. Sufism has inspired nearly all the best poetry of Persia, especially the writings of Hafiz and Sadi. See *Senussi.*

Sugar, a name given to a number of sweet-tasting substances of similar constitution which occur principally in the vegetable kingdom. Chemically they consist of polyhydric aldehydic or ketonic alcohols, which constitute a large section of the class of compounds known as *carbohydrates*, so termed from the fact that they contain hydrogen and oxygen in the proportion to form water. Sugars may be divided into two classes, namely, the *monosaccharoses* having the formula $C_6H_{12}O_6$, and the *disaccharoses* with the formula $C_{12}H_{22}O_{11}$. *Glucose* (dextrose or grape-sugar), *fructose* (lævulose or fruit-sugar), *mannose*, and *galactose* are monosaccharoses, whilst *sucrose* (cane-sugar), *maltose* (malt-sugar), and *lactose* (milk-sugar) are disaccharoses. The former are not decomposed by dilute acids, but the latter are readily hydrolyzed to a mixture of equal parts of two different monosaccharoses, or to one only. Thus from sucrose a mixture of glucose and fructose is obtained; from lactose, glucose and galactose; and from maltose, glucose alone. All sugars are optically active, i.e. a solution of a sugar rotates the plane of polarized light either in a right-handed (dextro-rotatory) or left-handed (lævo-rotatory) manner (see *Polarization of Light*; *Saccharimeter*). According to theoretical considerations, there should be eight different aldehydic monosaccharoses, each existing in two optically active forms; these sixteen forms are now all known, the majority having been prepared synthetically. It is mainly due to the work of the late Emil Fischer that the chemical structure and configuration of the sugars has been elucidated. The term sugar is commonly used to specify a particular member of the class, namely, *cane-sugar*, which is the most important one from the commercial and domestic point of view. This sugar occurs in sugar-cane, sugar-beet, and also in the maple, sorghum, and other plants, but the first two form the principal sources of supply. Originally introduced from India in the time of Alexander the Great, the sugar-cane gradually spread through Southern Europe; it was planted in the West Indies in the fifteenth century, soon after the discovery of America, and is now grown in most tropical and subtropical countries. The ripe plant, which contains from 15 to 20 per cent of sugar, is crushed between rollers to remove the juice, the crushed cane being further extracted with hot water. The juice is then treated with sulphur dioxide gas to prevent fermentation, and boiled down to a thin syrup. Milk of lime is added to neutralize vegetable acids and precipitate albuminous products, and, after skimming, the concentration is continued in steam-heated vacuum pans until crystallization begins. The crude sugar thus obtained is separated from the syrup (molasses), which may contain uncrystallizable products, by draining or centrifuging. It is then packed for sale as ordinary brown sugar, or refined to produce white sugar.

Beet-sugar is obtained from the sugar-beet, a cultivated variety of the sea-beet (*Beta maritima*) which grows wild on muddy sea-shores. The sugar manufactured in France, Belgium, Germany, and other European countries is obtained almost exclusively from the sugar-beet, which is grown as a field crop, and contains about 15 per cent of sugar. In 1747 sugar was first extracted from the beet by Marggraf, the first factory for this purpose being built near Breslau in 1799. In 1912 the first modern factory in England was opened at Cantley, in Norfolk; and in 1921 a factory was established at Kelham, Notts, the British Government subscribing £250,000 of the capital. In 1923 the Cantley and Kelham factories contracted for 15,000 acres of beet. The average yield per acre is about 10 tons, but in individual cases this may be much exceeded; in 1922, for instance, the yield which won the Mason cup for beet-growing amounted to 18 tons 6 cwt. per acre, with an average sugar content of 15·4 per cent. The world's production of beet-sugar is now about half that of cane-sugar.

The process of manufacture of sugar from the beet differs considerably from the process used for cane-sugar. The roots are trimmed, cleansed by washing, and cut up into very thin slices by special machines. The sugar is then extracted by a process based on the phenomenon of osmosis or membrane diffusion. The beet consists of a structure of cells, each of which contains sugar juice surrounded by a membrane. On soaking in water, the sugar and other substances capable of crystallization (crystalloids) pass through the membrane into the water, whilst non-crystallizable substances (colloids), such as albumin, gum, and pectins, are scarcely able to penetrate the membrane. This process will continue until the concentration of sugar in the water is equal to that remaining in the cells. If this solution is replaced by pure water, a further quantity of sugar will pass out of the cells. In practice the sliced beet is placed in a series of from ten to sixteen closed vessels connected up in a circle to form what is known as a diffusion battery. Pure water, heated to 60° or 70° C., is passed through the vessels so that it first comes in contact with cuttings which have been nearly exhausted, the sugar solution as it gets stronger meeting fresher and fresher cuttings. As the contents of each vessel are exhausted, it is cut off from the battery, filled with fresh cuttings, and placed last in the series. The diffusion process is sometimes carried out by forcing the cut beet slowly through a long cylinder in the opposite direction to a stream of hot water, thus dispensing with the need for a series of separate vessels. The exhausted cuttings, which should not contain more than 0·4 per cent of sugar, are pressed and used as fodder. The crude juice, in addition to sugar, contains salts, colouring-matters, gelatinous and other impurities, which prevent crystallization. These are removed by heating with lime (*separation*), the excess of lime being precipitated as chalk by passing in carbonic acid gas (*saturation*). The impurities are thereby either transformed into insoluble lime salts or carried down by the precipitate of chalk which is formed. The juice is then separated from the mud by filtration, and the sugar obtained by evaporation, &c., as in the case of cane-sugar.

The crude sugar, from whichever source it is obtained, is usually purified (refined) in special works. There are two methods in use. The first consists in covering the material with a solution of pure sugar, which gradually dissolves the syrup clinging to the crystals; these are then separated in centrifugal machines and allowed to dry. In the second method, the crude sugar is dissolved in hot water, filtered to remove suspended matter, and then run into steam-heated iron cylinders packed with bone charcoal, where it is allowed to remain until decolorized. The purified solution is then evaporated in steam-heated vacuum pans at a temperature of 82° C., more being added to the pan as the process continues. When crystals have been formed in sufficient amount, the pasty mixture or *masse cuite* is run off into centrifugals; the sugar remaining is washed in the machine with a spray of water, and finally dried and packed. The slightly yellow tint of the sugar may be concealed by adding a very small quantity of a blue colouring-matter, such as ultramarine. The syrups are evaporated further to yield a lower grade of sugar, the final residue in the case of cane-sugar being converted into golden syrup.

The syrups obtained in the manufacture of beet-sugar have a dark-brown colour and viscous consistency, and possess an unpleasant taste and smell. They contain about 50 per cent of sugar, which will not crystallize out owing to the large quantity of foreign matter present. By treating these syrups with a hot saturated solution of strontium hydroxide and cooling, the greater proportion of the sugar separates in the form of strontium sucrate. This is collected, suspended in water, and treated with carbonic acid gas to precipitate the strontium in the form of its carbonate. The filtered solution is then worked up in the usual manner. The syrups which remain after the crystallizable sugar has been separated by the above process are generally fermented to produce alcohol, or worked up for the salts they contain. Loaf- or cube-sugar is made by pressing the washed *masse cuite* into moulds and cutting the thin slabs into pieces of the required size, which are then dried.

Cane- or beet-sugar (sucrose), when pure, crystallizes in colourless four-sided prisms. It is very soluble in water, dissolving in one-third of its weight at ordinary temperatures, but is practically insoluble in alcohol and other solvents. On allowing a hot solution of sugar to cool gradually, large crystals may be obtained. Sugar-candy is prepared in this manner by stretching threads across the vat and allowing the crystals to grow on them. A solution of sucrose rotates the plane of polarized light to the right, a property that is largely made use of in *saccharimetry*, i.e. the estimation of the amount of sugar present in a sample. Sucrose does not reduce Fehling's solution, or ferment, until it has been hydrolyzed by acids or enzymes into a mixture of glucose and fructose. This decomposition is termed *inversion*, and the sugars obtained *invert-sugar*, owing to the fact that when the change has been completed the product is then lævo-rotatory. Sucrose melts at 160° C., solidifying on cooling to a pale-yellow glassy mass known as barley-sugar; at a higher temperature (205° C.) it loses water, and is converted into a brown substance termed caramel, which is used for colouring soups, gravies, beer, &c. Sugar is charred by concentrated sulphuric acid, with the formation of a black carbonaceous mass.

Sugar is valuable as a sweetening agent and forms an important article of food, being readily assimilated. It is rarely adulterated; in fact, loaf-sugar is almost chemically pure sucrose.

Statistics.—

WORLD PRODUCTION—BEET AND CANE
In millions of cwt.

1919–20	1920–1.	192 2	1922–3.
304	332	320	366

In Great Britain there is a heavy tariff upon imported sugar, which has yielded as follows:

CUSTOMS RECEIPTS—SUGAR

1919	£27,007,918
1920	40,887,584
1921	29,369,828
1922	35,947,068

Only five-sixths of the full rate is levied upon Imperial produce, but of a total of 27,427,000 cwt. of sugar imported into Great Britain during 1920, only 5,948,000 cwt. were Imperial produce. Imperial dominions producing cane-sugar include India (for home consumption), Mauritius, Uganda, Natal, Australasia, and the West Indies; beet-sugar is raised in Canada (34,600 tons in 1920–1). East Africa generally is regarded as a suitable region for an Empire sugar-producing colony. In Australia, cane-sugar raising is confined to Queensland and New South Wales, but

Queensland leads on account of its immunity from frost.

AUSTRALIAN SUGAR—PRODUCTION

	Queensland.	N.S.W.	Victoria.
	Tons.	Tons.	Tons.
1917–8	307,514	19,875	1,650
1918–9	189,978	12,278	1,263
1919–20	162,136	10,837	1,551
1920–1	167,401	15,124	883

The sugar of Victoria is beet-sugar. During 1919–20, 109,980 tons of cane-sugar, valued at £4,275,447, were *imported* into Australia, and 112,084 tons, valued at £6,339,408, were imported in 1920–1. The principal industry of Mauritius is sugar, and its chief exports, sugar, molasses, and rum. Over 88 per cent of the exports represent sugar. In 1920–1 the weight produced was 259,872 tons. Uganda is capable of great development, most of the sugar there being produced as jagree or crude sugar for native consumption, although some 520 cwt. were exported in 1916–7. The following is a comparative table of Imperial sugar production.

Colony.	1913–4	1920–1
	Tons.	Tons.
British India	2,291,500	2,349,000
Mauritius	249,800	259,872
West Indies	120,101	149,133
British Guiana ..	101,725	96,168
Fiji	100,000	73,000
Natal	87,715	140,000
Egypt[1]	69,370	79,706
Total	3,020,211	3,146,879

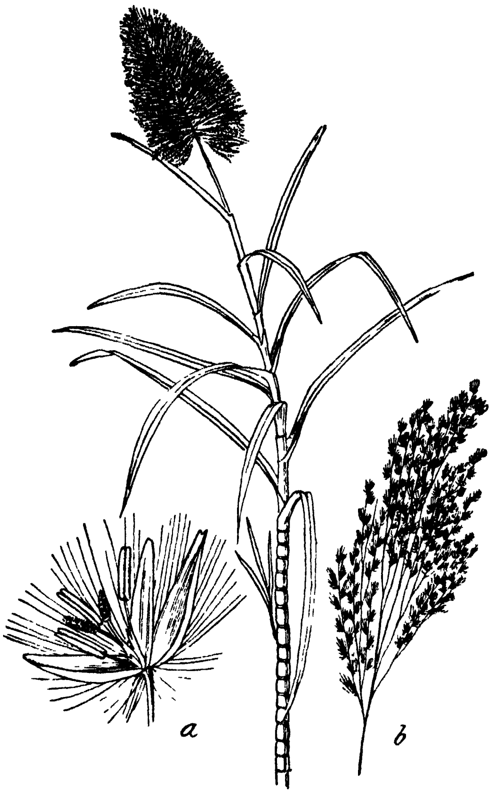
[1] Now a more or less independent kingdom.

The following table shows the import of sugar into Great Britain during 1921, and its value.

	Tons.	Value.	From
Refined	468,162	£14,916,323	U.S.A., Canada, and Java mainly.
Raw	814,839	20,422,493	Cuba, Mauritius, Java, West Indies, and Peru.

A comparison of the above table with that of Imperial production, bearing in mind the fact that no sugar is exported from British India, reveals the fact that Imperial production falls far short of even the United Kingdom demand. In the West Indies, and in Louisiana, Texas, Hawaii, Porto Rico, the Philippines, San Domingo, Haiti, the Virgin Islands, Cuba, and the beet-growing parts of the United States, the sugar supply is protected, and is controlled by a great sugar trust.

Sugar-cane (*Sacchărum officinărum*), a plant of the nat. ord. Gramineæ or grasses, from which a great part of the sugar of commerce is obtained. It is nowhere found in a wild state, but is probably a native of tropical Asia. It grows to the height of 7 or 8 feet or more, and has broad ribbed leaves, and smooth shining stems. It is now cultivated in all the warm parts of the globe, such as the West Indies, Brazil, Java, &c., but varies in rapidity of growth according to the situation, the season, or the weather. The sugar-cane flowers only after the lapse of an entire year, and a plantation lasts from six to ten years. The juice of the cane is so palatable and nutritive that during the sugar harvest every creature



Head of Sugar-cane Plant

a, A single flower. *b*, Part of the bunch of flowers.

which partakes freely of it appears to derive health and vigour from its use. For the process of making sugar, as well as for other information regarding this product, see the preceding article.

Sugar Convention. For many centuries the whole of the world's demand for sugar was met from the sugar-cane grown chiefly in tropical and, to a very small extent, in sub-tropical countries. In the middle of the eighteenth century a German chemist succeeded in extracting sugar from beet-root grown in a temperate climate. The new industry was slow in establishing itself, and a hundred years later the proportion of beet-sugar was still very small. From 1850 onwards it increased very rapidly, and by the end of the century beet-sugar had assumed a preponderating place in the sugar trade of the world. This rapid development was greatly fostered by the influence of tariffs. With the exception of Britain, which abolished the duty in 1874, most countries had long had import duties on sugar for revenue purposes, and when the new sugar industry assumed importance these duties were maintained and increased for protective reasons. At the same time, internal duties were levied upon the home-produced beet-sugar, but these duties were refunded to the producer on that part of the sugar which was exported. The internal tax took the form of a duty levied on the sugar-beet delivered to the sugar refiner, on the assumption of a given sugar content of the beet, but the drawback of duty was given on the actual amount of sugar exported. Improvements in the process of refining led in time to a much larger proportion of sugar being extracted from a given quantity of beet, with the result that the operation of the drawback on exported sugar constituted in effect a heavy bounty on exportation. Great Britain, which was the chief sugar-importing country, found her markets flooded with cheap bounty-fed sugar, to the great detriment of the interests both of her sugar refineries and of her West Indian possessions, from which she had previously drawn large supplies of cane-sugar. The British consumer, of course, benefited, as also did the jam- and biscuit-making industries. The competition between the Continental countries producing beet-sugar led to continuous increases in the scale of export bounties, until the whole situation grew intolerable. An attempt was made in 1888, at the instance of the British Government, to conclude an international convention to prohibit bounties on the export of sugar, but it proved impossible to reach agreement; and a similar fate befell a conference called by the Belgian Government in 1898. Finally, an agreement was reached which was embodied in the Brussels Convention of 1903, to which all the chief European Powers, with the exception of Russia, adhered. The signatory Powers agreed to suppress for five years all direct or indirect bounties favouring the export of sugar. In 1907 Russia became a party to the Convention on special terms, which, *inter alia*, contained the undertaking not to authorize the exportation of sugar in excess of 1,000,000 tons in any one year. In 1908 the Brussels Convention was extended for a further five years, but at the end of that period, in 1913, it was denounced by the British Government, owing to criticisms directed at some of the provisions, in particular, the limitation on Russian export, which it was held had caused sugar prices to rise. The European War brought with it great changes in the world's sugar production. The output of beet-sugar fell off very greatly, while the production of cane-sugar increased, and regained its old position of predominance. Although the British Empire produces about one-fifth of the world's sugar supply, nearly the whole of this is grown in British India, which (see *Sugar*) consumes the whole of its output. As a result, Great Britain is compelled to import from foreign countries practically the whole of her sugar supplies.

Sugar-mite (Glycyphagus), species of mites frequently to be observed in raw sugar, very similar in appearance to the itch-mite.

Suhl (sol), a town of Prussia, in the province of Saxony. It is a mining centre, and has manufactures of porcelain, leather, chemicals, and fire-arms. Pop. 14,500.

Su′idæ, the family of mammals of which the hog is the type. This family is characterized by having on each foot two large principal toes, shod with stout hoofs, and two short lateral toes which hardly touch the earth. The canine teeth project from the mouth and curve upwards. The muzzle is terminated by a truncated snout, fitted for turning up the ground. The family includes the wild boar, the wart-hog, and the peccary.

Suidas, Greek lexicographer, of whom nothing is known except that he probably lived about the tenth century A.D. The dictionary which he compiled is an encyclopedic work; although it is unequal and badly planned, it is valuable for its literary history, its explanations of words, and its quotations from lost works. The quality of each article varies directly with that of its source. The dictionary has probably been re-handled several times, and one of its editors—though not necessarily Suidas—was a Christian.

Suir, or **Sure**, a river rising in the Slieve-Bloom Mountains, Tipperary, Ireland. It forms the boundary between Tipperary and the counties of Waterford and Kilkenny, and after a course of about 80 miles it flows into Waterford harbour. It passes the towns of Cahir, Clonmel, and Carrick, and is navigable by barges to Clonmel.

Sukhum, a province of Georgia. Area, about 2500 sq. miles; pop. 209,700. The capital is Sukhum (pop. 62,000), with an open roadstead and quay, and one of the ten chief power-stations (electric) in Caucasia.

Sukkur, a district and town of Sind, Bombay Presidency, India. The district has an area of 5580 sq. miles; pop. 574,000. The town is the head-quarters of the district, and is an important strategic point on the North-Western Railway to Baluchistan, which crosses the Indus to Rohri by the Lansdowne Bridge at this point. Covering the approaches of the bridge there is a chain of forts, and the railway repair-shops are specially adapted for rifle defence. A scheme for utilizing the waters of the Indus in the irrigation of the waste lands of Sind is known as the Sukkur Barrage, and was approved by the Indian Government in June, 1921. Pop. 35,000.

Sulaiman Hills, a mountain range of India, once the Indo-Afghanistan frontier, now the Punjab-Baluchistan boundary. The Kaisargarh has two peaks, 11,295 feet and 11,070 feet altitude respectively.

Suleiman Pasha, Turkish soldier, born 1838, died 1892. He was an instructor in the Military Academy at Stamboul, and came rapidly to the front during the Russo-Turkish War, when he commanded in Herzegovina. Although he was the hero of the defence of the Shipka Pass against the Russians (1877), his Army of the Danube was defeated near Philippopolis, and he was degraded and condemned to imprisonment, but was soon pardoned by the Sultan.

Sulina, a Danubian river-port of Roumania, at the mouth of the Sulina branch. It has a lifeboat-station, two lighthouses, workshops of the European Commission of the Danube, elevators for the loading and unloading of cereals and coal, several big factories, and a quayage of about 2 miles for sea-going and river vessels. Pop. 9000.

The Sulina arm of the Danube, which is constantly dredged, is the only one of use for navigation. The delta is enclosed by the Kilia arm and the St. George arm, and the intervening mud-flats and marshes are traversed by the Sulina arm, navigable to Regensburg (Ratisbon) by barges of about 650 metric tons capacity. Sulina, the chief town on the delta, is only 2 feet above sea-level, and is built on piles, but the delta advances from 10 to 15 feet yearly, and is rapidly consolidating. Sulina is a great transhipment port for grain, &c.

Suliots, a mixed people of Albanian and Greek origin descended from Arnaout and Grecian shepherds, who, to escape the tyranny of the Turks in the seventeenth century, settled in the pashalik of Yanina (Albania), where they formed an independent republic (Suliote League), which struggled against Ali Pasha for eighteen years, and were dispersed by treachery in 1803, when Suli, their mountain fortress, was destroyed. They fled to the Ionian Isles, but later (1822) arrived in Greece and fought for Greek independence.

Sulla, Lucius Cornelius, Roman dictator, born in 138 B.C., died in 78. He received a good education, but was notorious from his youth upwards for his excessive dissipation and debauchery. He served with distinction under Marius in the Jugurthine (107 B.C.) and Cimbrian (104–102) Wars, and in 93 was chosen prætor. For his services in the Social War (90–88) he was appointed consul (88 B.C.), and the province of Asia, with the conduct of the war against Mithridates, fell to his lot. Marius was also ambitious of this command, and resorted to acts of violence to carry his point, by which Sulla was compelled to escape from Rome. But Sulla re-entered the city at the head of his army, drove Marius to Africa, and then sailed for Greece at the beginning of 87 B.C. He expelled the armies of Mithridates from Europe (86), crossed into Asia (84), and was everywhere victorious, gaining plenty of wealth for himself and his soldiers, and forcing Mithridates to conclude a peace. Marius had died in 86 B.C., after proscribing Sulla and confiscating his property, but the party of Marius was still strong. Sulla now hastened to Italy, and landed at Brundusium with 40,000 men (83 B.C.). He was joined by many of his friends who had been banished from Rome. He gained four battles over the Roman forces in person, and defeated a Samnite army under Telesinus. He entered the city victorious in 82, and immediately put to death between 6000 and 7000 prisoners of war in the circus. Rome and all the provinces of Italy were filled with the most revolting scenes of cruelty. After satisfying his vengeance by the murder or proscription of thousands, he caused himself to be named dictator for an indefinite period (81 B.C.). He now ruled without restraint, repealed and made laws, abolished the tribuneship, and settled his veterans in various parts of Italy. In 79 B.C. he laid down his dictatorship, and, retiring to Puteoli, abandoned himself to all sorts of debauchery.—BIBLIOGRAPHY: Plutarch, *Life of Sulla*; Sir C. W. Oman, *Seven Roman Statesmen*.

Sullivan, Sir Arthur Seymour, British composer, was born in 1842, and died in 1900. His father was bandmaster at the Royal Military College, Sandhurst, from 1845 to 1856, when he became a professor at the Military School of Music at Kneller Hall, a post which he held until his death in 1866. Sullivan was a precocious musician, at the age of twelve he was admitted one of the children of the Chapel

Royal, and he composed an anthem and published a sacred song at the age of thirteen. In 1856 he won a scholarship at the Royal Academy of Music, where he was taught by Sterndale Bennet (q.v.) and Goss. He continued his studies at Leipzig from 1858 to 1861, and wrote his celebrated incidental music for *The Tempest*, which was performed at the Crystal Palace in 1862 with instantaneous success. This music brought Sullivan into the front rank of contemporary composers when he was barely twenty.

His earlier works include: a ballet, *L'Ile Enchantée*; a cantata, *Kenilworth*; the overture to an unfinished opera, *The Sapphire Necklace*; and the *In Memoriam* overture. In 1866 he began his comic opera career by writing the music of *Cox and Box*. The libretto was an adaptation by F. C. Burnand (q.v.) of Maddison Morton's farce. Burnand also wrote the libretto for *Contrabandista* (1867). The ever-famous partnership with Sir W. S. Gilbert was inaugurated by the appearance of *Thespis, or the Gods Grown Old* (1871), but was not firmly established until the production of *The Sorcerer* (1877). (A full list of the operas written by Gilbert and composed by Sullivan will be found in the article *Gilbert, Sir W. S.*) These operas brought Sullivan fame and wealth, and it is they which have endeared him to the vast majority of his admirers. Sullivan's non-Gilbertian operas are: *Haddon Hall* (libretto by Sydney Grundy), *The Chieftain* (F. C. Burnand), *The Beauty Stone* (Pinero and Comyns Carr), *The Rose of Persia* (Basil Hood), and *The Emerald Isle* (Basil Hood), the last-named being left unfinished, but completed by Edward German. Sullivan also wrote a grand opera, *Ivanhoe* (Julian Sturgis), which ran for six months in 1891, but which never became popular. Sullivan's other works include: an overture, *Marmion*; an oratorio, *The Prodigal Son*; another oratorio, *The Light of the World*; a music drama, *The Martyr of Antioch*; and a setting of Longfellow's *Golden Legend*, considered by many his greatest work. He also wrote much church music of all kinds, including the well-known tune of *Onward, Christian Soldiers*; and many songs, of which perhaps the most popular was *The Lost Chord.* Sullivan never enjoyed good health, and died somewhat suddenly at the age of fifty-eight.

Sullivan had an unrivalled gift of melody; everything that he wrote is good music. In his light operas he showed himself as great a musical humorist as Gilbert was a dramatic humorist. His treatment of the wood-wind instruments is especially masterly. Yet even in his most apparently irresponsible passages he displays a reverence for art; his music is always scholarly and never pedantic. Some critics have found fault with him for squandering upon light opera the fertility and technical resource which he might have devoted to serious opera like *Ivanhoe.* It is doubtless to be regretted that Shakespeare did not employ his legal talents in writing a *Commentary on the Laws of England*, and that Molière did not utilize his undoubted dramatic gifts in writing a good heavy tragedy instead of a series of farcical and sometimes nonsensical comedies. The Savoy operas have given pleasure to thousands; they have satisfied Victorians, Edwardians, and Georgians alike; and their fame and that of Sullivan will not easily pass away.

Sully, Maximilien de Béthune, Duc de, French statesman, son of the Baron de Rosny, born 1560, died 1641. He was a Protestant (Calvinist), and, having attached himself to the court of Henry of Navarre (1571), he fought in the civil wars, escaped the massacre of St. Bartholomew, and assisted Henry generally in combating the League. In 1597 he became Surintendant des Finances and practically first minister of State. He was one of the great statesmen of France, concentrating on finance, palliating the burden of taxation, while increasing the State income from seven to sixteen millions by the abolition of tax-farming, and paying off an enormous State debt. Manufacturing industries were discouraged by Sully, who proclaimed tillage and grazing to be "the two breasts of France". In 1606 Sully-sur-Loire was erected into a duchy for him, and, after the murder (1610) of Henry IV (q.v.), he retired to his seat. Richelieu created him marshal in 1634. Sully's *Mémoires* (1638–62), which were translated into English (1756 and 1786), are valuable, but unpleasant and untrustworthy.

Sulphates, the salts of sulphuric acid. Sulphuric acid is a dibasic acid, and gives rise to two distinct series of salts, viz. the *normal* or *neutral* sulphates, in which the whole of the hydrogen of the acid is replaced by metallic radicles, e.g. Na_2SO_4 and $ZnSO_4$; and *acid* sulphates (or bisulphates), in which only part of the hydrogen of the acid has become replaced, e.g. $KHSO_4$ and $NaHSO_4$. Most of the sulphates are readily soluble in water. Gypsum, or calcium sulphate, $CaSO_4, 2H_2O$, is sparingly soluble, and barium and lead sulphates are insoluble. Some of the commoner sulphates are: alum, or double sulphate of aluminium and potassium; ammonium sulphate, obtained in gas-works, and used as a source from which other ammonium compounds are prepared; blue-vitriol, or cupric sulphate, $CuSO_4, 5H_2O$, used in surgery, in dyeing, and for preparing green pigments; green vitriol, or ferrous sulphate, $FeSO_4, 7H_2O$, used for making ink, and in dyeing and calico-printing; Epsom salts, $MgSO_4, 7H_2O$; Glauber's salt

Na_2SO_4, $10H_2O$; white vitriol, $ZnSO_4$, $7H_2O$, used in surgery, also in the preparation of drying oils for varnishes, and in the reserve or resist pastes of the calico-printer; quinine sulphate, used in medicine; and mercuric sulphate, $HgSO_4$. Numerous double sulphates besides alum are known.

Sulphonal, $(CH_3)_2C(SO_2C_2H_5)_2$, a drug used as a hypnotic. It is manufactured by condensing acetone ($CH_3{\cdot}CO{\cdot}CH_3$) and ethyl mercaptan ($C_2H_5{\cdot}SH$) in the presence of zinc chloride, and oxidizing the resulting mercaptol, $(CH_3)_2C(SC_2H_5)_2$, by potassium permanganate. Sulphonal occurs in the form of colourless, odourless, and almost tasteless prismatic crystals, or as a white crystalline powder. It is very stable, and little affected by acids, alkalis, or oxidizing agents. Its hypnotic action is due to its easy solubility in brain lipoid, and its insolubility in water. It is useful in simple insomnia unaccompanied by pain, but must only be used occasionally.

Sulphur (symbol, S; atomic weight, 32) is a non-metallic element which occurs in the free state chiefly in volcanic districts. The most important sulphur-bearing regions are in Sicily, Italy, Japan, the United States, and Iceland. In combination with other elements sulphur is widely distributed, occurring in the sulphates, gypsum (calcium), heavy spar (barium), Epsom salts (magnesium), and also in the sulphides, pyrites (iron, copper, arsenic), blende (zinc), galena (lead), cinnabar (mercury), and stibnite (antimony). These compounds, however, are not convenient sources of sulphur. Native sulphur usually occurs in large deposits and veins contaminated with stones and other impurities, and is obtained from the mixture by melting. A large heap, which may contain up to 2000 tons of sulphur stone, is built up on sloping ground and covered with the residue from a previous melting and finally with clay, air-holes being left at the top of the stack. The heap is then ignited and the lower opening of the furnace almost closed, so that the combustion proceeds very slowly through the heap. Some of the sulphur is burnt to sulphur dioxide, but the greater part is melted by the heat and trickles down into moulds placed at the bottom of the slope. The melting process takes from one to three months, according to the quantity of material. By the use of superheated steam, the melting can be performed more economically and without the production of sulphur dioxide, which causes great injury to the surrounding vegetation. A large quantity of sulphur is recovered from the waste calcium sulphide of the Leblanc soda process by Chance's method. The moist material is decomposed with lime-kiln gases (carbon dioxide) producing sulphuretted hydrogen. This gas is then burnt in a special furnace with a definite quantity of air, corresponding to the equation $2H_2S + O_2 = 2H_2O + 2S$, the sulphur fumes being condensed in chambers. Crude sulphur is purified by slow distillation from retorts into brickwork chambers, when the sulphur vapour condenses and forms a powdery deposit, the 'flowers of sulphur' of commerce. If the distillation is carried out more rapidly, the powder first formed melts to a pale-yellow liquid, which is cast into wooden moulds, forming 'roll sulphur'.

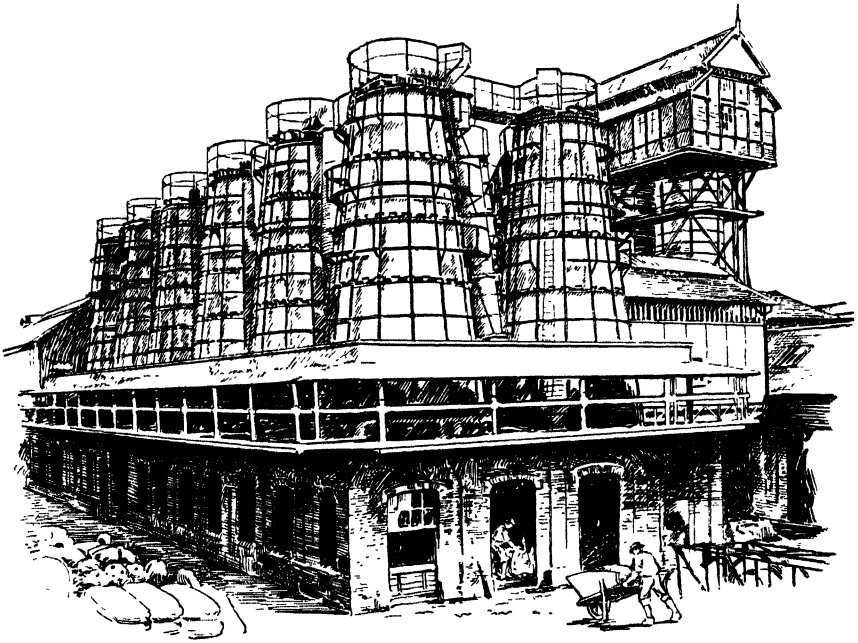
Sulphur exists in four allotropic modifications: the octahedral or rhombic, the prismatic or monoclinic, the plastic, and the amorphous variety. Native and roll sulphur consist of the octahedral variety, which may be obtained in large crystals from its solution in a solvent. It melts at 115° C. to a mobile amber-coloured liquid. Prismatic sulphur, which is only stable above 96° C., is obtained by melting the ordinary variety and allowing it to cool slowly. Plastic sulphur may be prepared by pouring molten sulphur, heated to a temperature of about 400° C., into water, when a tough rubber-like substance is obtained, which in a few days becomes hard and is transformed into the octahedral variety. Amorphous sulphur is precipitated when hydrochloric acid is added to a solution of sodium thiosulphate. The two crystalline forms of sulphur readily dissolve in carbon bisulphide, benzene, turpentine, &c., whereas the plastic and amorphous varieties are insoluble. On heating, all forms of sulphur melt to an amber-coloured liquid; on raising the temperature, the liquid turns redder and becomes more viscous, until at 230° C. it is almost black, and cannot be poured from the vessel containing it. On still further raising the temperature, it regains its mobility, and finally boils at 445° C., with the evolution of reddish-brown fumes. On cooling, these changes take place in the reverse order. Sulphur readily burns in air, forming sulphur dioxide; it combines directly with many metals, e.g. iron, copper, mercury, &c., and with non-metals, e.g. iodine, carbon, hydrogen, &c., with the formation of the corresponding sulphides. Sulphur is chiefly employed for the production of sulphur dioxide, used in the manufacture of sulphuric acid (q.v.), sulphites, &c., and also as a fumigating and bleaching agent. Sulphur is largely used for vulcanizing caoutchouc and gutta-percha (see *Rubber*); it is also a constituent of gunpowder and pyrotechnic mixtures. In medicine it is used externally as a parasiticide, and internally as a mild aperient.

Sulphur Bacteria, a common name for several kinds of bacteria which have the remarkable property of making use of sulphuretted hydrogen—

a gas highly poisonous to most organisms—as a source of energy; they store up granules of sulphur in their cells, afterwards oxidizing these to sulphates. *Beggiatoa*, which consists of slender unbranched filaments, is one of the best-known.

Sulphur Dioxide, or **Sulphurous Anhydride**, SO_2, a gas formed by the combustion of the element sulphur in air or oxygen. It is a colourless gas at ordinary temperatures, has a suffocating odour, and is readily soluble in cold water, forming an acid solution containing the unstable acid *sulphurous acid*, H_2SO_3. It is easily liquefied, either by pressure or by cooling it to $-18°$ C. at ordinary pressure. The liquid is now an article of commerce, and is placed on the market in glass siphons.

Sulphur dioxide in presence of water bleaches many colouring-matters, and is used in bleaching woollen goods, straw, and silk. It is also used as an *antichlor* to remove chlorine from paper, &c., which has been whitened by bleaching-powder. It acts as a strong reducing agent, as it is readily oxidized to sulphuric acid. Sulphur dioxide or its solution is useful as an antiseptic, as it arrests fermentation; it is also used in fumigating clothes and disinfecting the air of rooms. It is manufactured in enormous quantity from iron pyrites for the preparation of sulphuric acid.



Sulphuric Acid Plant

By permission of Messrs. Packards & James Fison (Thetford), Ltd., Ipswich

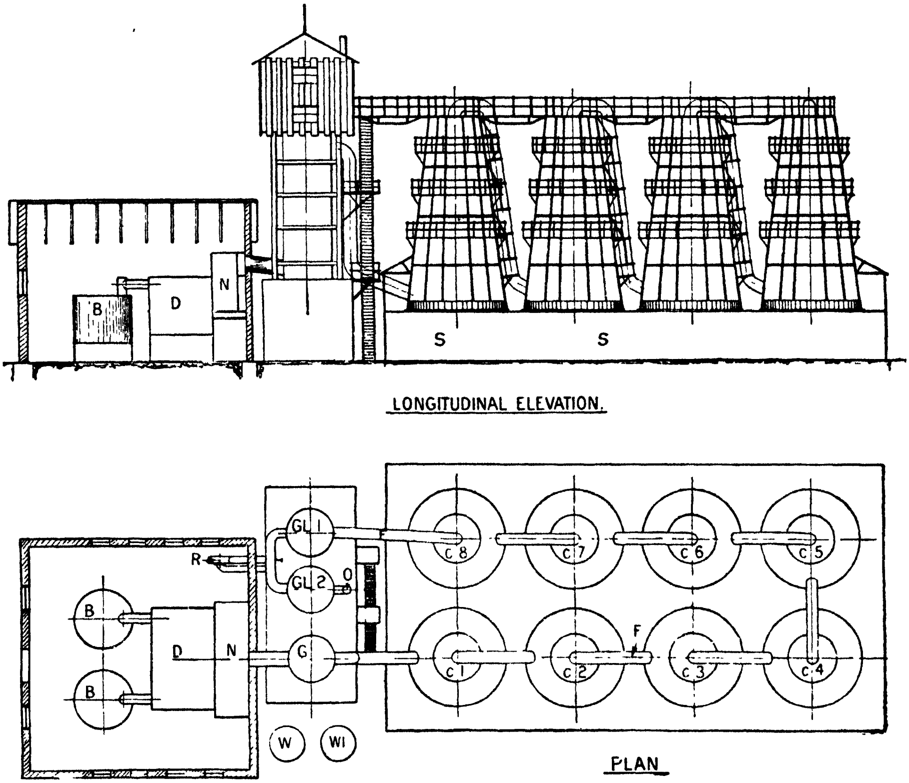
Sulphuretted Hydrogen, or **Hydrogen Sulphide**, H_2S, a compound formed when sulphur is burnt in hydrogen gas. It is usually prepared by decomposing ferrous sulphide (FeS) by means of dilute hydrochloric or sulphuric acid. It is a colourless, poisonous gas with an unpleasant odour resembling that of rotten eggs; it is heavier than air, and burns in air with the formation of water and sulphur dioxide. It occurs naturally in certain mineral springs, such as those at Harrogate, and is produced whenever animal or vegetable substances containing sulphur decompose. It is formed during the distillation of coal, and is therefore present in coal-gas before it is purified. The substance is a strong reducing agent, a weak acid, and forms a series of insoluble salts, the sulphides, of distinctive colour; on this account it is used largely as a reagent in analytical chemistry. The gas or its solution is easily identified by its odour, by the black stain it produces in coming in contact with a solution of lead acetate, and by the violet coloration produced when even a minute quantity of the solution is mixed with an alkaline solution of sodium nitroprusside.

Sulphuric Acid, or **Oil of Vitriol**, H_2SO_4, is prepared almost exclusively by one of two methods, namely, the ‘chamber’ process or the ‘contact’ process. In both cases the acid is formed by the oxidation of sulphur dioxide (SO_2) to sulphur trioxide or sulphuric anhydride (SO_3), which in the presence of water is immediately converted into sulphuric acid, $H_2O + SO_3 = H_2SO_4$. This oxidation, however, only takes place in the presence of a catalytic agent (see *Catalysis*).

The *chamber process*, first used in 1746, depends on the oxidation of sulphur dioxide by air, in the presence of nitrogen peroxide and water. The chemistry of the process is not thoroughly clear, and much discussion has taken place as to the stages in which the various reactions occur. The final result, however, may be expressed by the formula $H_2O + SO_2 + NO_2 = H_2SO_4 + NO$. The nitric oxide formed is reoxidized by means of air to nitrogen peroxide, which can then convert a further quantity of sulphur dioxide into sulphuric acid. The manufacture is carried out as follows. Iron pyrites is roasted in kilns with a regulated supply of air, whilst in the flues are placed earthenware pots charged with sodium nitrate (Chile saltpetre) and sulphuric acid. The hot gases, containing about 7 per cent of sulphur dioxide, pass over these vessels and become mixed with the nitric acid fumes liberated from them. Part of the sulphur dioxide becomes oxidized at this point by the nitric acid, but the greater proportion passes on up a *Glover tower*, which is lined with lead plates and loosely filled with flints or some other acid-proof material. Crude sulphuric acid containing dissolved oxides of nitrogen (see below) is allowed to trickle down this tower, the descending stream thus meeting the hot gases from the pyrites burners, which pass upwards through the tower and then into leaden chambers. The gases, which have thus been cooled and which contain sulphur dioxide, air, and nitric oxide, now come in contact with sprays of steam or fine jets of water. These chambers are made of sheets of lead welded together and supported by wooden frames. It is here that the main reaction takes place, the dilute sulphuric acid formed collecting at the bottom. After passing through two or more such chambers, the residual gases are passed upwards through a Gay-Lussac tower filled with coke, down which flows a stream of cold concentrated sulphuric acid, which absorbs the oxides of nitrogen present. The acid which collects at the bottom of the tower, together with the chamber acid which also contains oxides of nitrogen, is then pumped up to the top of the Glover tower. The process is thus continuous, and the oxides of nitrogen are used over and over again, but in practice a certain proportion is lost owing to other reactions taking place. This loss is made up by the small but constant supply from the nitre pots. As a rule about 3 or 4 parts of sodium nitrate are required for every 100 parts of sulphur burnt in the form of pyrites. The Glover tower serves three purposes: besides removing the dissolved oxides of nitrogen from the chamber acid and that which collects at the bottom of the Gay-Lussac tower, it cools the furnace gases from a temperature of about 300° C. to 60° C., and it finally serves to concentrate the chamber acid. At the same time, a certain proportion of sulphuric acid, apart from that which is generated by *denitration*, is actually formed in the Glover tower by the reaction between the sulphur dioxide and the oxides of nitrogen liberated from the acid which flows down the tower. The acid which collects at the bottom of the Glover tower has a specific gravity of about 1·73, and contains 80 per cent of sulphuric acid; some of this is pumped to the top of the Gay-Lussac tower, but the greater part is collected and may be used in this state for many technical purposes, e.g. in the Leblanc soda process, for the manufacture of superphosphate of lime. &c. For other purposes it is often necessary to remove impurities, such as arsenic, lead, and nitrous acid, which are always present in small quantities. The crude or the purified acid may be concentrated to 98 per cent (specific gravity, 1·84) by heating in shallow lead pans and finally in glass, porcelain, or platinum dishes, but as a rule the concentration is not carried further than about 93 to 95 per cent. In addition to pyrites, sulphur or sulphuretted hydrogen, prepared from the alkali waste of the Leblanc soda process, is used for the production of sulphur dioxide. The acid thus formed is free from arsenic and other impurities which are present in pyrites. Pure anhydrous sulphuric acid may be obtained by freezing the 98 per cent acid and collecting the crystals, but is more conveniently prepared by the process which will now be described.

The *contact process* owes its origin to the work of Winkler, who showed that a mixture of sulphur dioxide and oxygen combines under the influence of finely divided platinum to form sulphur trioxide, which is immediately converted into sulphuric acid on treatment with water. Other substances, such as oxides of iron and vanadium, may be used in place of platinum, but are not so satisfactory. On the manufacturing scale, sulphur dioxide containing excess of air is prepared by burning pyrites or other sulphur-containing substances as before. The gases are then purified, especially from dust and arsenic, which seriously interfere with the action of the platinum catalyst. They are then dried with concentrated sulphuric acid and passed into the contact chamber, which contains platinized asbestos. The reaction here takes place with evolution of heat; the temperature is prevented from rising above 450° C.

by external cooling. The sulphur trioxide formed is then absorbed in dilute sulphuric acid until the desired strength is obtained. By this means it is possible to prepare an acid containing any desired percentage of sulphur trioxide. The contact process is principally employed for the preparation of the 100 per cent acid, or the fuming variety, which contains excess of sulphur trioxide. This is extensively used for the production of explosives, and intermediate products for dye manufacture. In cases where a weaker and less pure acid is required, the chamber process is still the most suitable.



Plan and Elevation of Sulphuric Acid Plant. (By permission of Messrs Packards & James Fison (Thetford), Ltd., Ipswich.)

B, Mechanical pyrites burners. D, Dust chamber. N, Flue from dust chamber to Glover tower and nitre oven G, Glover tower. C1 to C8, Chambers (Mills-Packard) F, Connection pipes. GL. Gay-Lussac towers R, Regulus metal fan. S, Space under chambers W and WI, Coolers. O, Chimney

Fuming sulphuric acid, also known as Nordhausen, or pyrosulphuric acid, $H_2S_2O_7$, was originally obtained by the distillation of partially oxidized ferrous sulphate in clay retorts. It forms a colourless fuming liquid. Pure sulphuric acid, H_2SO_4, is a colourless, oily liquid without odour. It possesses a great affinity for water, and for this reason it is used as a desiccating agent, e.g. for drying gases. When the pure acid is poured on to wood, sugar, or many other substances of organic origin, it abstracts the elements of water, leaving a black carbonaceous residue. Sulphuric acid should always be diluted by pouring it in a thin stream into water, and not conversely, or violent ebullition will take place. Sulphuric acid is employed in a very large number of manufacturing processes, in fact it is one of the most important substances in technical use. Chemically, it acts as a dibasic acid, forming both normal and acid salts, the sulphates (q.v.).

Sulphuric Esters, compounds formed by replacing one or both hydrogen atoms of sulphuric acid by alkyl groups. For example, ethyl hydrogen sulphate, $C_2H_5HSO_4$, and diethyl sulphate, $(C_2H_5)_2SO_4$, are both esters of sulphuric acid, H_2SO_4. Diethyl sulphate is a colourless, poisonous liquid used for the introduction of ethyl groups into organic compounds.

Sulphuric Ether, another name for ordinary ether $(C_2H_5)_2O$. (For a short account, see *Ether.*) Its density is 0·722; specific heat, 0·53: boiling-point, 35° C.; freezing-point, $-117°$ C.; and index of refraction, 1·35. It is prepared by heating one part of concentrated sulphuric acid and two parts of ethyl alcohol in a distilling flask fitted with a condenser. Ether distils over when the mixture reaches a temperature of 140° C. It is collected in a cooled receiver, washed free from alcohol, dried, and redistilled. Ether is slightly soluble in water, and water is slightly soluble in ether, so that when ether and water are mixed the ether usually separates as a layer on the top of the denser water. On this account it is much used for separating organic substances from aqueous solutions, as they are usually much more soluble in ether than in water, and a small amount of ether can remove a considerable quantity of substance from a large volume of water. Ether is a valuable solvent for many organic substances, such as acids, hydrocarbons, phenols, oils, resins, &c., and for certain non-metals. It is used as a solvent for collodion in photography. It has anæsthetic properties, and is sometimes used instead of chloroform, or mixed with chloroform. It is employed also as a local anæsthetic for minor operations, as it takes up much heat during evaporation and so produces local freezing.

Ether is the best known of the class of organic compounds known as *ethers*, and consisting of two alkyl or aryl groups linked by one atom of oxygen; examples of these are *methyl ether*, $CH_3{\cdot}O{\cdot}CH_3$; *phenyl ether*, $C_6H_5{\cdot}O{\cdot}C_6H_5$; and *phenyl ethyl ether* or *phenetol*, $C_6H_5{\cdot}O{\cdot}C_2H_5$.

Sulphur-ore, a name often given to the mineral iron pyrites (q.v.).

Sultan, the ordinary title of Mahommedan rulers since the time of the Ghaznivid Mahmud (997–1030). The ruler of Turkey assumes the title of *Sultan-es-selatin*, 'Sultan of sultans'. The older English word, used by Scott and others, is Soldan.

Sultanpur, a district and town of the United Provinces, India. The district is traversed by the Gumti, and is served by the Oudh and Rohilkhand Railway. Native food-grains, rice, and sugar-cane are the staples. The town, on the Gumti, and served by a branch of the railway, is the district head-quarters. It occupies the site of old cantonments, and has good grain markets. Area (district), 1713 sq. miles; pop. 1,100,000; pop. (town), 15,000.

Sulu, an archipelago of over 400 Pacific islands, forming one of the forty-eight provinces of the Philippines. The larger islands are volcanic, and the smaller coralline. The total area is 1500 sq. miles; pop. 120,000. Pearl-shell, indigo, teak, rice, coffee, and cotton are among the productions. Sulu, on Sulu Island, is the capital.

Sumach

Sumach (sū'mak, Rhus), a genus of shrubs of the nat. ord. Anacardiaceæ, with pinnate leaves and small flowers. They all have a lactescent acrid juice, and most of them possess valuable tanning properties. More than seventy species are known. *R. coriaria* is found in the countries about the Mediterranean. Its roots contain a brown, and its bark a yellow dye. The leaves and seeds are used in medicine as astringent and styptic, and the leaves are exported for use in tanning, dyeing, and calico-printing. *R. typhīna* is an American species with hairy branches, hence its common name of stag's-horn sumach. It produces small red berries, and is cultivated in European gardens for ornament. *R. glabra*, another American species, is also grown for ornament, and its berries and branches are used for dyeing purposes. *R. venenāta*, commonly called dog-wood or poison sumach, is a shrub of the American swamps. It grows from 12 to 20 feet high, and produces greenish-white flowers. It is extremely poisonous, in some cases giving rise to inflammation of the skin, followed by a pustular eruption. *R. radicans*, often called poison ivy, is a climbing variety. It affects certain individuals in the same manner as the poison sumach, but it is less virulent. The leaves of several of these species are now extensively collected in America for tanning or other purposes. The celebrated Japan varnish is obtained from a species of Rhus with downy and velvety leaves. The varnish oozes from the tree when wounded, and grows thick and black when exposed to the air. For currier's sumach, see *Coriaria.*

Sumatra, an island of Malaya, one of the Dutch East Indies (q.v.), marking the easternmost extremity of the Malay Archipelago. It lies across the equator, and is separated by the Straits of Malacca from the British-Malayan mainland. Sumatra and Java (q.v.) are physically similar; but Sumatra, although three times as large as Java, supports a smaller population, and is less fertile and not so highly developed. The backbone of the island is a high volcanic mountain chain falling on the north-east and south-west to coastal plains. Maize, camphor, tobacco, and black pepper are produced, together with those commodities mentioned under *Java.* Minerals include: gold (from near Jambi and Palembang), coal (in the Padang Highlands), magnetite and copper ore (Central Highlands), and tin (Siak Valley, Banca, and Billiton Islands, &c.). Padang is the chief port; Deli (tobacco centre), Palembang (Musi River; a coffee, rubber, and black-pepper exporting centre), Telok-Betong, and Sabang—a new and fully equipped port and coaling-station on the north-west of the island (Malacca Straits), sheltered behind the Island of Weh—are the chief towns. Area, 159,740 sq. miles; pop. 5,027,000.

Sumba, or **Sandalwood**, an island, the third in size, of the Lesser Sunda group, Dutch East Indies. It has a low and sandy northern coast and a precipitous southern seaboard; the hinterland rises in flat terraces from the coasts. Of rivers only the Kambera is navigable (for about 1 mile). Waingapu (pop. 1000) is the chief town. Maize is the staple, and the sandalwood, which gave the island its original name, has almost disappeared through haphazard clearance. Sumba horses are the best in the Dutch East Indies for size and strength. Tobacco, cotton, rice, and indigo are raised, and sago is exported.

The Dutch East India Company were shipping sandalwood from Sumba in the seventeenth century, and the island was also a slaving centre. Later, trouble with the natives led to the abandonment of the company's interests, and in 1866 the first Dutch officials took up their duties. Area, 5290 sq. miles.

Sumbal, or **Sumbul**, an Eastern name for the root of an umbelliferous plant, ***Euryangium sumbul.*** It contains a strongly odorous principle, like that of musk, and is regarded as an anti-spasmodic and stimulating tonic. Also an Eastern (Arabic) name of spikenard (q.v.).

Sumba'wa, an island of the Dutch East Indies (Lesser Sunda Islands). It comprises several native states, tributary to the Timor Residency. Bima (pop. 2000) is the port and largest town; the Bay of Bima, 16 miles long, is one of the finest in the Dutch East Indies. Sumbawa and Maumere (a port) are other towns. Sulphur, arsenic, and petroleum are found; cinchona, bees'-wax, tobacco, sapon-wood, rice, and teak are produced; and buffaloes, horses, goats, and sheep are exported. The three towns have a trade with the Celebes and Java. Sumbawa is mountainous, and in the north is the volcano Temboro (7600 feet altitude). The inhabitants are Mahommedan-Malays. Area, 4300 sq. miles; pop. 75,000.

Sumerian. *Shumer*, a Babylonian word occurring in the cuneiform inscriptions, is possibly equivalent to the Heb. *Shin'ar* = *Sennar*, and it is certainly the *Shinar* of the Old Testament, Shinar and Shumer (Sumer) being synonyms for Babylonia. Shinar is mentioned in *Gen.* x, 10 as possessing four chief cities, Babel (Babylon), Erech, Accad, and Calneh, and it is also mentioned in *Gen.* xi, 2, and xiv, 1, 9. In *Is.* (xi, 11) and in *Zech.* (v, 11) the word occurs once only in each book, when it is an obvious archaism, and is rendered by the *Septuagint* as ' Babylonia ' and ' land of Babylon ' respectively. The geographical use of the term lapsed possibly after the time of Moses. Of many problems connected with the Sumerians, the study of none of them has been attended by so much difficulty as the philological, for the Sumerian language was greatly influenced by grammatical Semitisms, although probably not itself a Semite language; but supporters of Halévy's postulate are convinced that the so-called Sumerian language is not a language but a cryptography, based upon the Semitic speech of the day, and used in the temples by the priestly caste. See *Ur.*

Summary Proceeding, in law, said of a form of trial in which the ancient established course of legal proceedings is disregarded, especially in the matter of trial by jury. In no case can a party be tried summarily unless when such proceedings are authorized by legislative authority, as in a committal for contempt of court, the conviction of a person by justices of the peace, &c.

Summer, the season of the year which in the northern hemisphere generally may be said to comprise the months of June, July, and August. The astronomical summer lasts in the northern hemisphere from the June solstice to the September equinox. During summer the sun, being north of the equator, shines more directly upon this hemisphere, and is above the horizon for a longer proportion of the time, which renders this the hottest period of the year. The period of greatest heat generally takes place in July, since the influence of the sun's rays has then produced an accumulated effect on the earth. In the southern hemisphere the astronomical summer lasts from the December solstice to the March equinox.

Summer-duck (*Aex sponsa*), a species of duck, allied to the mandarin duck or Chinese teal (*A. galericulata*), and distinguished as a genus by a short bill with a large horny tip and straight edges, and by the hinder toe being unconnected to the other digits. These birds inhabit North America, and usually build their nests in the hollows and trunks of trees. The summer-duck has been found capable of domestication.

Summerside, a town of Prince County, Prince Edward Island, Canada, on Northumberland Strait; served by the island railway. Beef-packing, lobster-packing, flour-milling, and the making of rolled oats and threshing-machines are progressive industries. The town is the centre of a fox-ranching industry. Pop. 3230.

Summer Time Act, Act of the British Parliament providing for an extension of daylight between spring and autumn by the simple expedient of advancing the hands of the clock by one hour ahead of Greenwich time on a specified date in spring, and setting them back by one hour on a specified date in autumn. The originator of this scheme of ‘ daylight saving ’ was William Willett, a builder in London, who advocated it vigorously, but died in 1915 before its adoption. In 1909 a Daylight Saving Bill had been introduced in Parliament, but it was dropped, and it was the exigency of war that brought the scheme again to the front as a means of saving light and fuel. The Summer Time Act, 1916, was therefore passed, and by it Greenwich mean time was advanced one hour on 21st May and restored on 30th September in that year. The scheme, though opposed by some, proved popular, and has been kept in force in each succeeding year, usually for a period of six months. In 1922 a Bill designed to perpetuate the change and to make it synchronize with the period adopted by other countries which had taken up the scheme was brought into Parliament. It proposed to fix summer-time between the night of the last Saturday in March and the night of the first Sunday in October in each year. It met with strong opposition, especially from agricultural interests, which had consistently opposed the scheme, and concessions had to be made. The Bill as amended became law on 20th July, 1922, and provides that summer-time in Great Britain, Northern Ireland, the Channel Islands, and the Isle of Man shall, after the year 1922, extend from 2 a.m. Greenwich time on the day next following the third Saturday in April (or if that day is Easter, the day next following the second Saturday) to the same hour on the day next following the third Saturday in September. The Act expires on 31st Dec., 1923, unless Parliament otherwise determines. The intention is to renew it annually under the Expiring Laws Continuation Act.

Summons, in law, a writ addressed to the defendant in a personal action, admonishing him to appear in court. It must contain the names of all the defendants, the name and address of the person taking it out, and the date of issue, and must be endorsed with a statement of the nature of the claim to be made or the remedy required. A summons should be served on the defendant in person; but if reasonable efforts are made to do this, and the defendant is aware of its issue, the judge may authorize the plaintiff to proceed in the action without personal service, or may order substituted service. Service is dispensed with if a defendant through his solicitor agrees to accept service and enters appearance. The law of Scotland requires a summons to contain the grounds and conclusions of the action. It is issued from the Court of Session in the sovereign's name, but in an inferior court it is issued in the name of the judge or magistrate presiding over that court. Most initial writs in actions in the inferior civil courts are now, however, in the form of ‘ petitions ’, upon which the court endorses a warrant requiring the defender to appear and answer, the forms of summonses being still retained only in actions not exceeding £20 in value.

Sumner, Charles, American jurist and politician, born 1811, died 1874. Educated at Harvard University, he was called to the Bar, and became reporter of the United States Circuit Court. Between 1844 and 1846 he edited and published *Vesey's Reports*, in twenty volumes. In 1851 he was elected to the Senate, and championed the emancipation of slaves. In 1861 he became chairman of the Senate committee on foreign relations. He opposed both the policy of President Johnson and the home and foreign policy of President Grant.

Sumner, John Bird, British divine, son of a clergyman, born 1780, died 1862. Educated at Eton and Cambridge, he entered the Church, and became rector of Mapledurham. In 1820 he was made Canon of Durham, in 1828 Bishop of Chester, and in 1848 Archbishop of Canterbury. His works include: *The Evidences of Christianity* (1824), *Lectures on the Gospels and Epistles* (1831–40), and *Practical Reflections* (1859).

Sumptuary Laws, or legislation to restrain extravagant living, can be found in many ages and countries. Such enactments were a common expedient in Greece and in Rome, and they are found in mediæval Europe. In the fourteenth century, for example, the English Parliament regulated the number of courses at dinner and the wearing of foreign cloth, furs, or silk. Some of these enactments were intended, in the first place, for the encouragement of native manufactures, and this motive remained after the legislators lost faith in the practicability of enforcing purely sumptuary statutes. Thus, while in seventeenth-century England sumptuary laws were repealed, royal proclamations and parliamentary statutes ordered the burial of corpses in woollen grave-clothes in order to encourage the wool trade and to discourage imported linen. These laws continued in force until 1815. In Scotland, on the other hand, new sumptuary laws were passed in the seventeenth century to restrict expenditure on mournings and on funeral feasts. In modern times the only relics of such legislation are to be found in the small taxes imposed upon the use of armorial bearings, &c., and in the heavy duties on spirits, wines, and tobacco. The difficulty of organizing a system of taxation on luxuries was illustrated by the unsuccessful efforts in this direction made in 1917–8, as a part of the policy of restriction of imports, necessitated by the European War. A proposal to this effect was adopted in France, and was carefully considered by Mr. Bonar Law in framing his Budget of 1918. He appointed a Select Committee to frame a schedule of ‘ luxuries ’, but the project had to be abandoned.

Sun, the central body of the system to which the earth belongs. Its diameter is 867,000 miles, or 109 times that of the earth. Thus it exceeds the earth in volume about 1,300,000 times, but in mass about 330,000 times, as its mean density is only 1·4 times that of water, or one-fourth of the earth's. Its axis of rotation is inclined 7° to a normal to the ecliptic, towards that position which the earth occupies at 7th September. Observation of sun-spots and spectroscopic observations show that the rotation period varies in different latitudes, being about 24½ days at the equator, and 33 days in latitude 75°. Thus the sun does not rotate as a solid body. This fact, as well as its low density, indicates that it is largely in a fluid condition. Viewed in the telescope the sun's surface presents a mottled texture, with minute bright parts or *granules*, and dark parts or *pores*. These are in a constant state of rapid flux and change. There are larger bright portions or *faculæ*, and dark portions or *spots*, the latter of all sizes up to tens of thousands of miles in extent. Spots also are evanescent phenomena. They often appear in groups or trains, frequently with two large members and many smaller ones. The different degrees of shade in a spot are distinguished as nucleus, umbra, and penumbra. Spots may last only a few days, but large ones may persist for weeks, and thus be seen in several successive solar rotations. They appear mainly in two zones of latitude north and south of the equator. Sunspots wax and wane in numbers in a period of about eleven years. Electric particles seem to be shot out from spotted areas, which affect the magnetic state of our globe, as the passage of large spots is frequently attended by magnetic storms and auroræ. Records of terrestrial magnetism and auroræ also clearly exhibit the same eleven-year periodicity.

The luminous exterior of the sun which radiates its light is called the *photosphere*. Over this is a thin shell of cooler gases called the *reversing layer*, which absorbs some of the light, and causes the dark lines in the solar spectrum. Above this is the *chromosphere*, or sphere of colour, a region 5000 to 10,000 miles deep, glowing with reddish light, which is seen in total eclipses around the dark limb of the moon. Its appearance has been compared to a prairie on fire. It is in a state of commotion, rising at places into *prominences*, or *red flames*, which are projected to tens, or, in exceptional cases, to hundreds of thousands of miles. ‘ Eruptive prominences ’, consisting mainly of metallic elements, undergo great changes in the course of hours, or even minutes, but ‘ quiescent prominences ’, composed mostly of hydrogen and helium, float like clouds in our atmosphere. Formerly prominences could be seen only at total eclipses; now they are continuously under observation by spectroscopic methods. Farthest out of all is the *corona*, or sun's outer atmosphere, very greatly exceeding in bulk all the rest of the sun. It can be seen only at total eclipses, and can be observed, without any instrumental aid, as an aureole of pearly light surrounding the dark moon. It is of very tenuous structure, as comets have passed through it with no appreciable resistance. Its spectrum shows the presence of hydrogen, and of a gas unknown terrestrially, which has been named *coronium*, and it also appears to contain minute solid particles or dust, which reflect the sunlight.

The sun's mass is 750 times that of all the planets combined. Its attraction upon the earth in tons is represented by the figures 36 followed by 17 ciphers. If this attraction were transmitted through a material bond, it would require a bunch of steel wires, each as large as the heaviest telegraph wires used, and covering the sunward hemisphere of the earth, nine to the square inch. The effective temperature of the sun's surface is estimated at 6000° C., or about 10,000° F. The sun gives us 7000 million times the light of the brightest star, and in a year sufficient heat to melt a layer of ice 30 yards thick spread over the surface of the earth. But we get less than one 2000-millionth of the total heat radiated. If the sun were covered with ice 50 feet deep, the heat emitted would melt this in one minute. A minute proportion of the sun's energy may be supplied by meteoric impact, and a much larger proportion by its secular contraction and by radioactive transmutations. But probably a large part comes from sources as yet only dimly surmised, and it is now being suggested that the radiation of the sun and other stars is largely derived from an actual conversion of an extremely small fraction of their total mass into energy, the matter as such becoming annihilated in the process.—BIBLIOGRAPHY: C. G. Abbot, *The Sun*; H. Deslandres, *Annales de l'Observatoire d'Astronomie Physique de Paris*; G. E. Hale, *Stellar Evolution*; C. A. Young, *The Sun*; R. A. Sampson, *The Sun*; Sir R. Ball, *Story of the Sun.*

Sun and Planet Motion, in mechanics, a train of two epicycloidal wheels, used by James Watt on the steam-engine. The sun wheel (on a central axis) is usually rotated by the other, or planet wheel, which is attached to the connecting-rod. See *Epicycloidal Wheel*; *Steam-engines.*

Su'nart, Loch, a sea-loch of Scotland, in Argyllshire, opening into the Sound of Mull. It is about 20 miles long, and varies in breadth from less than ½ mile to 3 miles.

Sun-bear, a name applied to some of the Indian species of the genus Ursus. The Tibetan sun-bear (*U. tibetanus*) is a black species with a white patch on the breast. The Bornean sun-bear (*U. eurysypilus*) has an orange-coloured patch. The Malayan sun-bear or bruang is a very small species. (See *Bear.*) All the sun-bears are slenderly made, and their fur is not so heavy and thick as that of the other bears.

Sun-bird (*Nectarinia metallica*)

Sun-bird, the name given to a family (Nectariniidæ) of perching birds, which are confined to the tropical regions of Africa and Asia, and in brilliant plumage and habits resemble the humming-birds. They live on insects and the juices of flowers; their nature is lively and their song agreeable. They build in the hollows of trees or in thick bushes. Some species (such as *Nectarinia lotenia* and *N. asiatica*) make dome-like nests, which they suspend at the extremities of twigs or branches.

Sun-bittern, a South American bird (*Eurypyga helias*), rather smaller than a curlew, but with much shorter legs and a slender, straight bill. It frequents the banks of rivers, feeding on insects and small fishes. When excited, it drops its normal deliberate gait and goes through an extraordinary performance, dancing about with its broad and beautifully marked wings and tail fully spread. The bird has been somewhat of a puzzle to naturalists, but, like the *kagu* of New Caledonia, it is now generally regarded as a relic of an ancient type akin to the rails.

Sunbury, an urban district of Middlesex, England, on the Thames. It is a boating centre, and contains Kempton Park and race-course. Pop. (1921), 5400.

Sunbury, a borough of Pennsylvania, United States, the county seat of Northumberland county, on Susquehanna River; served by the Pennsylvania and the Philadelphia & Reading Railways. The silk manufacture is most important, but there are also railway repair-shops. Founded in 1772, Sunbury became a borough in 1797. Pop. 17,000.

Sunda, Strait of, a strait between the Islands of Sumatra and Java, and connecting the China Sea and the Indian Ocean. It is about 100 miles long.

Sunda Islands (Lesser), Dutch East Indian island-chain extending west to east for 700 miles, between Java and Timor. The Greater Sunda Islands are Java, Sumatra, Borneo, and Celebes; the Lesser, Bali, Lombok, Sumbawa (largest), Flores (second in size), Solor, Adunara, Lomblen, Pantar, Alor, Sumba (Sandalwood), Savu, Rotti, and the smaller dependent islands. Netherlands geographers, however, do not recognize this division, classifying all the Dutch East Indies as either 'Java and Madura' or 'Outposts'. *Physical.*—The main chain comprises a line of volcanic mountains trending east to west, and culminating in Rinjani (Lombok Island). All the islands are mountainous and have small coastal alluvial plains. Forming a southern line of outposts of the main chain are Sumba, Savu, and Rotti. Rivers generally are torrential from December until March, when they begin to dry up. The mean temperature is 78° to 80° F. *General.*—The chief peoples are the Hindu Balinese of Bali and Western Lombok, and the Sassaks of Eastern Lombok (Mahommedan) and Western Sumbawa (where the population includes Arabs and Chinese, &c.). Otherwise the people are mainly pagan. Malay is the lingua franca. Malaria, cholera, beri-beri, and dysentery are common. *Production.*—Bali and Lombok are of greatest economic importance. Articles on various islands should be consulted.

Smaller Islands.—Savu joins with Rotti to form a division of Timor Residency. Food is not plentiful, and emigration to Rotti is considerable. Seba is the capital. Area, 231 sq. miles; pop. 14,000. The Solor, Adunara, Lomblen, Pantar, and Alor Islands are culturally backward. Their peoples are seafarers engaging in pearling, and using shell as a monetary standard. Adunara is the richest agriculturally.

Sundarbans, or **Sunderbunds,** a vast tract of forest and swamp forming the southernmost portion of the Gangetic Delta, at the head of the Bay of Bengal; extreme length along the coast, about 165 miles; greatest breadth, 81 miles; and area, 7532 sq. miles. The northern parts only are inhabited, the southern parts being jungle and thick underwood traversed by gloomy-looking watercourses. The Sundarbans abound in wild animals, including tigers, leopards, rhinoceros (nearly extinct), buffaloes, deer, monkeys; the python and the cobra abound; crocodiles infest the river channels. Port Canning is the only town of importance.

Sunday (that is, day of the sun, like Monday, day of the moon), the first day of the week, the Lord's day. See *Sabbath.*

Sunday Closing. In Scotland the Forbes MacKenzie Act (q.v.) of 1853 enacted the closing of all public-houses and other licensed premises on Sunday, but *bona fide* travellers and lodgers might be supplied at a licensed inn or hotel. By the Licensing Act, 1921, however, the *bona fide* traveller is abolished. In Wales Sunday closing of licensed premises has obtained since 1881, and it also obtains in Monmouthshire. Otherwise in England licensed premises may open on Sundays for five hours, of which not more than two shall be between 12 noon and 3 p.m., and not more than three between 6 p.m. and 10 p.m., the permitted hours within these limits being fixed by the licensing justices of the district. The increase of Sunday trading generally has led to a movement for closing all shops on Sunday, with certain specified exceptions.

Sunday Schools. The Sunday school in its simplest form is a meeting for children at which religious instruction is given in classes, generally by laymen and women, for the purpose of training the children in Christian principle and belief. To-day non-Christian bodies, such as the Buddhists in Japan and the Socialists and Communists in Great Britain, are copying Sunday-school methods for their own ends; but the idea is essentially a Christian one. The immediate forerunners of Sunday schools were the little day or evening classes where good men and women taught reading, spelling, and morals with the Bible for their only textbook. Organized Sunday schools were first heard of in Scotland in 1709, and a little later in England; but the recognized founder is Robert Raikes (1735-1811), a Gloucester journalist, who, filled with sympathy for the poor children running wild in the streets of his native town, gathered them into the first Sunday schools. Through his writings Raikes was able to make known to the English public the need for Sunday schools, and the movement spread rapidly. At first ecclesiastical leaders were inclined to look askance on the work of laymen (even the law feared seditious or political teaching), but the Churches soon found in this method a very necessary supplement to the instruction given from the pulpit and around the family hearth. To-day most denominations provide lesson schemes and teacher training courses for the schools connected with their churches; but the early period, when the work was managed almost entirely by the voluntary efforts of laymen, has left a great heritage in the unions of Sunday school workers, both local and national, founded for mutual help and guidance, and still most valuable for their progressive and interdenominational spirit. The two great unions in Britain are the National Sunday School Union and the Scottish National Sabbath School Union, and similar organizations exist in Canada, the United States, South Africa, many European countries, India, Japan, &c. All these unions are linked together by the World's Sunday School Association, which has its head-quarters in the Metropolitan Tower, New York City, and secretaries in many of the home and foreign fields. Conventions are held quadrennially in different parts of the globe, attended by delegates from all nations. At the last Convention, held in Japan, 1920, it was estimated that the total membership of Sunday schools the world over was 30 millions of children and teachers, with a steady annual increase of 1 million.

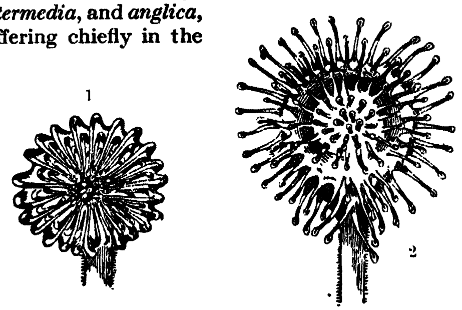
To-day the Sunday school is much more elaborate and methodical than of old, though it continues to be staffed by voluntary labour. The aim is to lead all children into the Christian fellowship of the Church by training them in Bible knowledge, in worship, and in service. The first step is to connect the little babies with the Sunday school by means of the 'cradle roll'; this is in the care of a motherly secretary, and is closely linked with the primary department, which has a beginners' class for four-year-olds. In the primary department thoughts of the loving Fatherhood of God and the friendship of Jesus Christ for little children are taught by means of Bible story, Nature talk, and simple hymn and prayer. About the age of eight, boys and girls pass into the junior department, where the theme is the Hero Christ with His forerunners, the heroes of the Old Testament, and His followers, the hero disciples and missionaries; memory work and training in the worship of the Church are features of this department. The intermediate department—senior classes for boys and girls of twelve to fourteen—does work of a more intimate and personal nature, showing the meaning of Christianity to the individual and to the world to-day, and preparing for the young people's department or Bible classes with their more advanced study of Christian history and citizenship. The principal textbook in all departments is the Bible.

For all this work trained teachers are needed, not necessarily trained for day schools, but specially prepared for this work. Many Churches and unions have normal courses for the training of teachers; often the Sunday school has a special class for training its own teachers; but in Britain the plan that meets with general acceptance is to staff the primary department with lads and girls in their ' teens ', who attend a compulsory weekly training class, and get their practical experience with little groups of three or four children on Sunday, to whom they teach a lesson previously gone over by a skilled leader. After some three years they pass on to the junior department, where they attend a weekly discussion circle; in this way the individual Sunday school maintains its own supply of young trained teachers. Summer schools and local training courses provide further instruction, while leaders can be fully trained at special colleges. In Great Britain there are three such: the National Sunday School Union's College, Westhill, Birmingham; St. Christopher's, Blackheath, belonging to the Church of England; and the Women's Missionary College of the United Free Church of Scotland, Edinburgh.

From its humble beginning as a philanthropic institution for the poorest and neediest children, the Sunday school has come to be the nursery of the Church, and, as its nursery, of central importance in this children's era. The term Sunday school must not, however, be limited to children's work, for, in some cases, it includes classes for adults of all ages who gather together for Bible study.

Sunderland, a municipal and county borough and seaport of Durham, England, at the mouth of the Wear; served by the London & North-Eastern railway group. It includes nearly the whole of three parishes—Sunderland, Bishopwearmouth, and Monkwearmouth. There is a seaside suburb (Roker). The harbour and docks covers 200 acres, and its entrance is formed by two stone piers with lighthouses; two outer piers enclose a harbour of refuge. Shipping, the coal trade, and shipbuilding, the making of marine engines, iron-work, bottles, glass, earthenware, rope, &c., are the chief industries. Coal is the chief export; the imports are chiefly timber and grain, with various raw materials and provisions, from the Baltic ports, Holland, &c. Pop. (1921), 159,100.

Sun-dew (Drosĕra; nat. ord. Droseraceæ), plants growing in bogs and marshes, having leaves clothed with reddish hairs bearing glands which exude drops of clear glutinous fluid, glittering like dew-drops, whence the name. The three British species are *D. rotundifolia*, *intermedia*, and *anglica*, differing chiefly in the shape of the leaves. A characteristic of these plants is their habit of capturing insects by their viscid secretion. Darwin, in his *Insectivorous Plants* (1875), says that the sun-dew derives its nitrogenous food by absorption from the tissues of insects entangled in the inflected tentacles of its viscid leaves; while, like other plants, it obtains and assimilates carbonic acid from the air. He further shows that these leaves have the power of digestion, and that they act on albuminous compounds in the same manner as does the gastric juice of higher animals, the digested matter being afterwards absorbed. The digestive faculty has also been traced in the butterwort, the pitcher-plant, &c. See *Carnivorous Plants.*

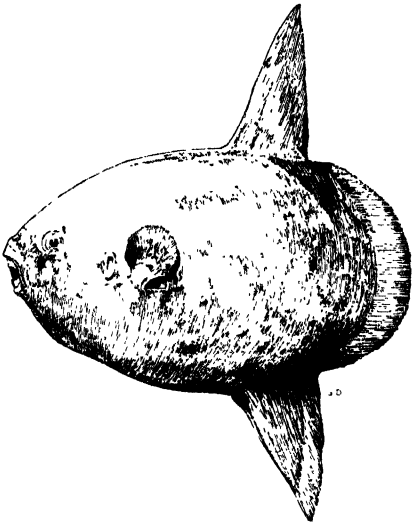


Leaf of Sundew (magnified)

1. Leaf with all its tentacles curved in towards the middle.
2. Leaf with all its tentacles extended.

Sundsvall, a seaport of Vesternorrland län, Sweden, on the Gulf of Bothnia, near the mouth of the Indalself. Iron, steel, and wood-pulp are made; timber is exported. Pop. 17,000.

Sun-fish (Orthagoriscus), a remarkable genus of fishes belonging to the order Teleostei, suborder Plectognathi. These fishes are short and almost circular in form, their jaws are undivided, and they have no swimming-bladder. The sunfish appears like the head of a large fish separated from its body, and when swimming it turns upon itself like a wheel. It grows to a large size, often attaining a diameter of 4 feet, and sometimes even that of 12 feet. The skin is hard and leathery, but the flesh is soft, white, and palatable. The liver is large, and yields an oil highly valued amongst sailors as a cure for rheumatism.



Sun-fish

The sun-fish is found in all seas from the Antarctic to the Arctic Circle. The two most familiar species are *O. mola* and *O. oblongus.*

Sun-flower (Helianthus), nat. ord. Compositæ, a genus of plants, so called from the resemblance of the yellow flowers to the sun with his golden rays. The root is mostly perennial; the stem herbaceous, upright, and often tall; the leaves opposite or alternate, undivided, often rigid and scabrous; the flowers large and terminal, usually disposed in a corymb. The species are numerous, and mostly inhabit North America. The gigantic sun-flower (*H. annuus*), common in gardens, is a native of Peru. The stem is from 6 to 15 feet in height; the flowers, sometimes 1 foot in diameter, are usually turned towards the south. The seeds form an excellent nourishment for poultry and for cage-birds; and an edible oil has also been expressed from them. For the *Helianthus tuberosus*, or Jerusalem artichoke, see *Artichoke.*

Sunn, or **Sunn-hemp,** a material similar to hemp, imported from the East Indies, and used chiefly in the manufacture of certain types of ropes and box-cords. It is obtained from the stem of the *Crotalaria juncea,* a shrubby leguminous plant 8 to 12 feet high, with a branching stem, lance-shaped silvery leaves, and long racemes of bright-yellow flowers. Called also *Bombay hemp, Madras hemp, false hemp, Jubbulpur hemp.*

Sunnite, or **Sunni,** the Orthodox division of Islam, as opposed to the Shi‘ites, or Unorthodox division. The essential difference between them is that the Sunnites accept the *Sunna* as well as the *Koran,* and the Shi‘ites do not. The name Sunnite is derived from the word *Sunna,* meaning law or practice, and was given to a posthumous collection of the sayings of Muḥammad, and some account of his works, both largely traditional (*hadith*).[1] That this was needed there can be no doubt, for the *Koran* recognizes absolutely no difference whatever between spiritual and temporal matters, and the rapid welding of all-conquering Islam into a gigantic empire appears to have been entirely unforeseen by the Prophet, who made no provision for suitable laws, &c. It was said that Muḥammad had left such laws in the keeping of Ali, but the compilation was completed from the personal recollections of the Prophet's followers. Orthodox Islam is divided into four sects, all of which date from the early days of the Abbasids: (1) *Shafi‘ite* (founded by ash-Shafi‘i, (2) *Hanifite* (founded by Abu Hanifa), (3) *Malekite* (founded by Malek ibn Anas), and (4) *Hanbalite* (founded by ibn Hanbal) still existing in small numbers. All Sunnites belong to one or other of these rites. The division is scattered throughout the domains of the former Turkish Empire, and the claim of the Turkish sultan to the Caliphate (i.e. spiritual hegemony in Islam as vicar of God) is more or less admitted by the Sunnites generally. The Moroccan dynasty, however, has never recognized the Turkish Caliphate. Afghanistan, Muslim India, Turkestan, North Africa (see *Senussi*), and the nomad Tatar tribes of Asia are Sunnites, although the latter are only nominally such. The Great Schism in Mahommedanism was occasioned after the death of Muḥammad (who did not appoint his own successor) by the rise of two opposing parties, one of which (the Sunnites) supported the authority of the early Caliphs, while the other (the Shi‘ites), ‘ the party of the Prophet's House ’, asserted that the supernatural powers of Muḥammad passed, through his daughter Fatima, to Ali and his descendants. The differences between the sects have been manifested in disputes regarding the Caliphate; and the Ottomans regarded the office largely from a political standpoint, as opposed to the Shi‘ite view of its non-political and almost purely spiritual significance. The *Shi‘ite* division forms the State religion of Persia. It has given to the world the Mahommedan poets, while the *Sunnite* division has provided the great Islamic warriors.

---

[1] It has been argued that a great deal of what he did not say and did not do has also been included. The great part that custom plays in the daily life of the modern Arab must be realized before the importance of the *Sunna* can be fully grasped

Sun-stroke, any sudden and severe injury to the health resulting from the exposure of the head to a hot sun. The most usual symptoms of sun-stroke are the following: pains in the head, accompanied by fever; lethargy, or suffering which prevents sleep; congestion of the brain or other nerve-centres, or an inflammation of the brain sometimes ensues, and often terminates fatally. Sometimes the effects of the stroke can be discerned only in impaired bodily health or mental vigour dating from some occasion on which the patient was exposed to a violent sun.

Sun-worship, the adoration of the sun as a divinity sending and distributing light and heat, on which life and the fertility of the earth depend. Sun-worship is found among primitive as well as among more civilized nations. " The sunrise ", writes Professor Max Müller, " was to man at the dawn of time the first wonder, the first beginning of all reflection, all thought and philosophy." The chief object of adoration of the Aryans was the sun, which was to them not merely a luminary but a Ruler and a Creator, a Preserver and a Saviour of the world. He drove away the darkness and fertilized the earth. The principle of light, the Surya of the Hindus, Ormuzd of the Persians, Osiris of the Egyptians, Heracles and Dionysus of the Greeks, and Balder of the Teutons, was opposed to the principle of darkness, and imagined as engaged in a perpetual struggle. Among the Persians, Peruvians, and Mexicans sun-worship was afterwards amalgamated with fire adoration. The Aryans migrating east and west took their sun-myths with them and spread the cult of the sun. —BIBLIOGRAPHY: Charles Morris, *Aryan Sun-myths*; J. R. Harris, *The Heavenly Twins.*

Sun Yat-sen, Dr., Chinese revolutionary, born 1867, a Cantonese by birth, but born in Honolulu; a Christian by religion, from his Christian parentage and early education in a missionary school; and a medical graduate of the American College in Hong-Kong, where he studied between 1887 and 1892. He favoured politics, however, becoming leader of the Chinese revolutionary movement, and was for fourteen years a political exile. The Revolution of 1911-2, which culminated in the fall of the ancient Manchu dynasty and the establishment of a Republic, owed its success largely to the influence of Sun Yat-sen, who, from patriotic motives, passed the Presidency in favour of Yuan Shih-kai, who ultimately became Dictator. On the death of Yuan, he organized the Southern (Canton) party, and the fratricidal strife, which for years cleft China in two, was the child of his unscrupulous and anarchical political machinations. In April, 1921, the Canton Parliament elected him ' President of the Chinese Republic '; but the new State was soon in financial difficulties, and, during the Civil War of 1922, the troops of Sun Yat-sen were decisively defeated (17th June). On 9th Aug. his army was again defeated (by Chan Chiung-ming), and Sun Yat-sen fled to Shanghai. Subsequently General Wu Pei-fu, the victorious leader of the North who overthrew Marshal Chang Tso-lin of Manchuria, connived at the assistance rendered the latter from Canton, and a path was thus cleared for negotiations. During 1923, it was announced that the Southern Government recognized the Peking Government and would unite with it. See *Peking.* Sun Yat-sen died in March, 1925.

Supererogation, Works of, in the Roman Catholic Church, the name for a class of good works which are considered to be not absolutely required of each individual as conditions to salvation. Such good deeds, it is believed, God may accept in atonement for the defective service of another.

Superheater. Steam is said to be superheated when at any given boiler pressure it has a higher temperature than the water from which it was evaporated. The object in superheating is to eliminate condensation in the steam-pipes and engine cylinders. The design of a superheater depends on the type of the boiler with which it is used. Owing to superheated steam having a comparatively low heat conductivity, it is essential that the superheater elements be of ample length to allow sufficient heat to be taken in by the steam. In the case of smoke-tube superheaters this is of special importance, the necessarily small diameter of the elements leading in these to high steam velocity.

A superheater consists of three parts: (1) the distributor, (2) the elements, (3) the collector. The distributor receives the saturated steam from the boiler through the regulator valve, and distributes it to the various superheating pipes or elements. The distributor and collector, especially on locomotives, are generally combined in one casting, commonly called a ' header '. The superheater may either form an integral part of the boiler or be independently fixed. A flooding arrangement is sometimes fitted to prevent the elements being burnt out when raising steam from cold water. The superheater is filled with water to the boiler level, and, prior to opening the regulator valve, the water is drained away. In general, about 100° to 150° F. of superheat is provided for, although in many cases steam superheated by 250° to 260° F. is employed.

Superior, in Scots law, one who or whose predecessor has made an original grant of heritable property on condition that the grantee, termed the *vassal*, shall annually pay to him a certain sum (commonly called feu-duty) or perform certain services. The superior's relation to the property so granted is called *dominium directum*, while the vassal's right in the property is called *dominium utile*.

Superior, Lake, one of the Great Lakes, the largest expanse of fresh water in the world, and the most westerly and most elevated of the North American chain of lakes. It washes the shores of the state of Minnesota on the west, those of Wisconsin and the northern peninsula of Michigan on the south, and those of Ontario in all other directions. Its greatest length is 353 miles; greatest breadth, 160 miles; circuit, about 1750 miles; area, about 32,000 sq. miles (or the same as that of Ireland). It is 602 feet above sea-level, and varies in depth from 80 to 200 fathoms. The lake receives many small streams, and finds an outlet at the south-east (to Lake Huron) by St. Mary's River. Duluth, Superior, Marquette, Port Arthur, &c., are lake ports. Navigation proceeds all the year round, as only the shore area is ice-bound in winter.

Super Tax (Lat. *super*, above), a form of income tax levied on the higher incomes, namely, those above £2000. The tax was first imposed in 1909, but only on incomes exceeding £5000, the rate being 6*d.* per £1, and being levied only on the excess over £3000. In April, 1914, it was extended to all incomes exceeding £3000, the first £2500 being exempt. The rate was varied, and rose from 5*d.* to 1*s.* 4*d.* by successive income stages, each stage up to £8000 of income bearing its own particular rate, and the maximum rate being imposed on all income above that figure. Further increases were made from time to time as the exigencies of the European War demanded. The last revision was made in 1920, when all income in excess of £2000 was brought into charge under the following scale:

On income	exceeding	£2000	but not	£2500,	rate	1*s.* 6*d.*
,,	,,	£2500	,,	£3000	,,	2*s*
,,	,,	£3000	,,	£4000	,,	2*s.* 6*d.*
,,	,,	£4000	,,	£5000	,,	3*s*
,,	,,	£5000	,,	£6000	,,	3*s.* 6*d.*
,,	,,	£6000	,,	£7000	,,	4*s*
,,	,,	£7000	,,	£8000	,,	4*s.* 6*d.*
,,	,,	£8000	,,	£20,000	,,	5*s.*
,,	,,	£20,000	,	£30,000	,,	5*s* 6*d.*
,,	,,	£30,000	..	.. ..	..	6*s.*

The tax is charged on the income of the year preceding that of the assessment. Earned income is taken at the full figure, and there are no deductions for life assurance premiums, or for personal, marriage, or family allowances as in the case of the ordinary income tax. The full share of profits of the person chargeable must be taken into account although only a portion may have been drawn. The tax is not levied on companies, and a shareholder brings into account only what he receives therefrom by way of dividends. This leads to the formation of companies for the sole purpose of evading the tax, and accordingly the Finance Bill, 1922, seeks in certain circumstances to bring undistributed profits under liability.

Supple-jack, a popular name given to various strong twining and climbing shrubs. The supple-jack imported into Europe for walking-sticks is the barked branches of one or more West Indian species of Paullinia, nat. ord. Sapindaceæ. The name is also given to a rhamnaceous twiner (*Berchemia volubilis*), found in the Southern States of America.

Supplicants, The, a name assumed in 1637 by the petitioners against the introduction of Laud's Service Book and the Book of Canons into the Scottish Church. The Supplicants signed the Covenant in 1638, and were thenceforward known as Covenanters.

Supply of Electricity. Electricity is a purchasable service, but its generation and sale in any particular district, and also the installation within a consumer's premises, are regulated by Government Acts and Orders. An order for permission to supply electricity in any area must be obtained before any general scheme may be started. With a view to obtaining economical production, the grant of such orders and permissions to extend present equipment are only given after careful inquiry by the Electricity Commissioners. The present tendency is towards generation in bulk in what may be termed a super power station, and whatever scheme is suggested must be considered in relationship to the possible linking up or disbandment of many small stations.

Charging for Electricity.—The electricity supply people usually provide the service connections, and generally without any direct charge; but when the cost is high, the consumer may be offered connection on paying for the service connections or by guaranteeing a certain minimum annual payment. The systems of charging for electrical energy are regarded by some consumers as most unnecessarily involved. They can appreciate the significance of charging by the simple meter reading, as is done with gas. Such a system is frequently used, but is not perfectly satisfactory, in that with it no account of the time at which the demand comes on the system is made. Meter charging at so much a cubic foot or therm serves for gas, as all the supply is taken from storage; whereas with electricity the case is different, as, generally speaking, the electricity must be generated at the moment of demand. It is for that reason that the apparently involved systems have been introduced. If supply is only taken at times of low load, it may be supplied cheaply, but if taken at peak times, the cost is much greater, for every addition to the possible peak load means an increased size of power plant. The various systems in use have as their aim the assignment of an equitable cost to each consumer, made up of interest on capital, cost of plant, and actual production charges. In some cases consumers have the option of paying a flat rate of a certain sum each year, or paying a percentage of the rateable value of the premises, together with a small charge per unit. Amongst other methods, one in fairly common use is to make a charge against the number of kilowatts of maximum demand. In artisans' dwellings a fixed charge for the current for each lamp installed is a method much in favour.

Wiring Rules.—All electrical work in a house or workshop should be carried out to the specifications embodied in the rules of the fire insurance company, of the Institution of Electrical Engineers, and of the local supply authority.

Supra-renal Capsules, two small yellowish glandular bodies which exist, one at the front portion of the upper end of each kidney (see *Kidney*). They have no excretory duct, and are connected with the kidneys by areolar tissue only. They consist of an outer or *cortical*, and an inner or *medullary* portion; the former being of a deep yellowish colour, and the latter of a dark-brown or black hue, and of a soft and pulpy formation. The capsules are furnished with numerous nerves, and derive their blood from the *aortic*, *renal*, and *phrenic* arteries, returning it by the *supra-renal* vein. They are present in all mammals. Their exact functions are as yet uncertain. In the embryo they are larger than the kidneys themselves, but in the adult possess only about $\frac{1}{28}$th of their original bulk. See *Addison's Disease*; *Adrenalin.*

Supremacy, Royal, as a term in English law, is practically restricted to denote the authority of the Crown in matters ecclesiastical. After the abolition of the Papal supremacy at the English Reformation, the royal supremacy was affirmed by various Acts under Henry VIII and Elizabeth, all enforcing an *oath of supremacy.* The oath was taken by holders of public offices along with the oath of allegiance, and afterwards with that of abjuration, until the three were consolidated in one by 21 and 22 Vict. c. 48. This was again subjected to revision in 1868.

Supreme Court of Judicature, an English court constituted by the Supreme Court of Judicature Act, 1875, which provided for the union and consolidation together of the higher courts, such supreme court consisting of two permanent divisions called the *High Court of Justice* and the *Court of Appeal* (see *Law, Courts of*). The ordinary judges (or justices) of the High Court have equal power, authority, and jurisdiction, but they sit in three divisions: the Chancery division, consisting of five justices, with the Lord Chancellor of England as president; the King's Bench division, consisting of fourteen justices and the Lord Chief Justice as president; and the Probate, Divorce, and Admiralty division, consisting of two judges or justices. The criminal jurisdiction of the court is exercised entirely by the King's Bench division. The Lord Chancellor is not to be deemed a permanent judge of the court. The Court of Appeal has appellate jurisdiction only, with such original jurisdiction as may be necessary to dispose of cases of appeal. It consists of four ex-officio judges and of five ordinary judges appointed by letters-patent. The ordinary members of the court are called Lords Justices of Appeal. The four ex-officio judges are the Lord Chancellor, who is the president, the Lord Chief Justice of England, the Master of the Rolls, and the President of the Probate, &c., division. The Court of Appeal is a superior Court of Record, and the highest court of appeal under the House of Lords. In hearing ecclesiastical appeals the court is composed of judges and assessors, the latter being archbishops or bishops of the Church of England. The supreme courts and any of the judges are at liberty to sit at any time or place. Commissioners of assize on circuit are continued. Matters not proper to be heard by a single judge are to be heard by divisional courts of the High Court consisting of three or not less than two judges. The determination of these divisional courts is to be final, unless the court gives special leave to appeal. Until 1907 no appeal lay from a criminal verdict, but only on the ground of misdirection of the jury on a point of law, on which ground the High Court might quash the conviction. (In that year, however, a new Court of Criminal Appeal was set up, and appeals on wider grounds can be taken to it from the judgment of the court at quarter sessions, assizes, the central criminal court, or the King's Bench division of the High Court.)

Surabaya. See *Sourabaya.*

Suraj'ah Dow'lah (*Siráj-ud-Daulah*), the last independent nawab of Bengal, under whom was perpetrated the massacre of the Black Hole (q.v.). He succeeded his grandfather, Ali Verdy Khan, in 1756, and within two months of his accession found a pretext for marching on Calcutta. On the arrival of Clive and Admiral Watson he retreated to Murshidabad, but was routed at the battle of Plassy (23rd June, 1757). He then fled up the Ganges, but was betrayed, and executed by order of the son of Mir Jaffier, the new nawab. Surajah Dowlah's reign lasted fifteen months, his age at the time of his death being barely twenty.

Surat′, a district and city of Bombay province. The district is a broad alluvial plain with a coastline along the Arabian Sea; served by the Bombay, Baroda & Central India, and the Tapti Valley Railways. Rice, cotton, wheat, castor-oil, and native cereals are raised. Surat City is the district head-quarters, and was formerly the commercial capital of India. Area (district), 1651 sq. miles; pop. 656,000; (city), 120,000.

Surety. A surety is one who has become bound for the due payment of a debt or performance of an obligation by another person. A contract of suretyship must be in writing, the Statute of Frauds enacting that no action shall be brought on the promise of anyone "to answer for the debt, default, or miscarriage of another person" unless such promise is evidenced by writing. But only a collateral agreement or guarantee need be so evidenced. If the promise is of the nature of an indemnity, it is binding though not reduced to writing. Thus A and B go to a tailor; A orders a suit of clothes; B says to the tailor, "If A does not pay you, I shall do so"; that is a guarantee and requires writing. But if B says, "Charge the cost to me", he makes himself the debtor, primarily responsible for payment, and writing is unnecessary.

Unless otherwise provided by the contract, the creditor may proceed against the surety for payment without first suing the debtor. A surety who pays comes in place of the creditor, and is entitled to the benefit of the securities held by him. If the creditor has accepted a modified sum from the surety, the latter cannot recover more from the debtor. If there are several co-sureties, anyone who pays the debt has relief against the others for their shares.

Surf-duck, or **Surf-scoter**, a species of duck (*Oedemia perspicillata*), about the size of a mallard, rarely seen on the British coasts, but frequent on the coasts of Labrador, Hudson Bay, and other parts of North America. See *Scoter*.

Surgeons, Royal College of, an English medical body established in London, descended from the Company of Barber-surgeons, incorporated by royal charter in 1461. A separate association of surgeons was formed some years later, but in 1540 the two companies were united by Act 32 Henry VIII cap. xlii into one corporation under the title of Masters or Governors of the Mystery and Commonalty of Barbers and Surgeons in London. In 1745 the latter were raised into a separate corporation. By a new charter granted in 1800 the title of the company became the Royal College of Surgeons in London; and by another charter granted in 1843 the name of the corporation was changed to that of the Royal College of Surgeons of England; and the college was authorized to create a portion of its members fellows. The government of the college is vested in a council of twenty-four members, including president and vice-presidents, the whole to be fellows of fourteen years' standing. A court of examiners of ten members (fellows), with a president and two vice-presidents, is elected by the council. The college also appoints special examiners in midwifery, dental surgery, and in various departments of scholarship, preliminary to fellowship examination. The examination for membership of the college includes a preliminary examination in general scholarship, an anatomical examination, and the surgical or pass examination. By the Medical Act, 1858, the college is one of the bodies authorized to license practitioners of medicine within the United Kingdoms (see *Medical Act*). The buildings of the college are on the south side of Lincoln's Inn Fields. They contain a museum, library, and theatre for lectures. The museum is one of the most valuable scientific collections in the world. The new examination hall, held conjointly with the Royal College of Physicians, is at 8–11 Queen Square, Bloomsbury.

Surgery. While certain procedures which would now be called surgical operations are at least sixty centuries old, and the regular practice of surgery goes back at least as far as the time of Hippocrates, the last century has witnessed such a tremendous extension of the range and the accuracy of the surgical operations, that it is perhaps not an exaggeration to say that Sir James Young Simpson and Lord Lister have created a new art by introducing the use of chloroform and antiseptic procedures respectively. The earliest-known inhabitants of Egypt already practised a form of circumcision, which was performed for ritual rather than for surgical purposes, and the custom of amputating a finger for similar reasons is as old if not even older. The use of splints for treating fractures of the arm and leg goes back at least as far as the Pyramid Age in Egypt (*British Medical Journal*, 28th March, 1908). The practice of trephining (popularly known as trepanning) the skull is probably almost as ancient, and has existed among primitive people in various parts of the world for many centuries.

But real surgical operations, i.e. using the knife definitely for the cure of disease, were unknown before the sixth century B.C. Although practised by the Greeks in Ionia and Cos, surgery was probably first established on an extensive scale by the Greek practitioners in Alexandria about 300 B.C., and by them the art was handed on to Syria and Europe. The renaissance of learning in Europe in the sixteenth century, and especially the increased attention then given to anatomy, acted as a great stimulus to surgery, for it provided the operator with a much more intimate knowledge of the geography of his field of operations, and hence gave him confidence to undertake procedures which before then he would not have dared to attempt. However, until the introduction of the use of anæsthetics in the nineteenth century, surgical operations were attended with such risks and caused such terrible agony to the subjects of these operations that they were rarely submitted to except when the alternative was death. Moreover, one of the chief aims of the surgeon was to complete the operation as rapidly as possible, so that the careful technique of the modern surgeon was almost impossible of attainment. The introduction of the use of anæsthetics changed all this. It not only spared the patient the awful agony and the shock that went with it, but it made operations safer, and it permitted the surgeon to practise his art in a more careful and thorough manner. Nevertheless, there was always the risk of septic infection, which added immensely to the danger of any surgical operation. Lord Lister's application to surgery of the knowledge of germs, acquired largely as the result of Pasteur's researches, has brought about a complete revolution in the art. It made it possible for the surgeon freely to invade regions like the abdomen and the cranial cavity: this before his time would have involved the gravest risks. It has made it possible also for him to perform numerous plastic operations which it would have been useless for him to attempt in the days when he knew that suppuration was inevitable. But, more important than even these two results, it has given surgery a safety and a precision which was lacking before Lister's time, so that vast numbers of operations are now performed on almost any part of the body without submitting the patient to any exceptional risk or grave discomfort, such as he would have had to suffer a century ago.

At the present time several anæsthetic procedures, both of a general and a local action, are used in surgery, and the danger of accidents due to the anæsthetic has been considerably reduced. Instead of attempting to destroy the infective agents in the wounds made by the surgeon, and so run the risk of injuring the patient's tissues, the modern surgeon aims at asepsis, i.e. he tries to prevent germs from gaining access to the wound. For this purpose the surgeon and his assistants adopt elaborate measures to sterilize the instruments and their own hands, and by means of careful attention to the preparation of the operating-room and the patient, and by the use of special clothing and masks, they prevent the access to the seat of operation of anything at all likely to convey infection.

Surgical operations are undertaken for a variety of objects, such as the removal of foreign bodies (bullets, &c.) from the body, or concretions or calculi from the bladder, kidney, gall-bladder, or other hollow organ; the removal of cancerous or other forms of growth which involve risk to life or grave discomfort to the patient, or of dead or diseased tissues, such as carious bone or teeth, gangrenous intestine, inflamed appendix, &c., which may be either dangerous or disagreeable; the relief of obstructions in any of the hollow tubes of the body, such as the intestines or the air-passages; the relief of conditions such as hernia, which may involve the risk of such obstructions or even danger to life; or the opening and draining of abscesses and the evacuation of unnatural accumulations of fluid in the pleural or other cavities of the body. In addition to these varieties of surgical procedures, surgical operations are frequently performed to correct congenital defects, like club-foot, knock-knee, hare-lip, and a whole series of deformities that come within the province of the orthopædic surgeon. Similarly, many operations are now performed to remedy defects caused by injuries, such, for instance, as transplanting skin, or plastic procedures to make a new nose when that organ has been lost, or to effect some other repair to a face whose æsthetic qualities have been marred.

The greatest triumphs attained by surgery within recent years have been the direct result of the confidence and freedom from grave risk which the use of anæsthetics and aseptic methods has made possible. The surgeon can now confidently open up the body cavity or the brain case, and deal directly with deep-lying tumours or diseased conditions. He can remove calculi from the gall-bladder or kidney, cut away cancerous growths from the stomach or intestines, and remove large parts of the alimentary canal, or even the whole uterus and its appendages. He can excise tumours of the brain and relieve abscesses within the skull. He can open the spinal canal and relieve pressure upon the spinal cord or the nerves. He can correct the effects of displacement of organs by strengthening the normal supports of such organs as the uterus or kidneys. But all of his procedures do not involve the use of the knife. He sets broken bones and performs many operations on joints without cutting. The surgeon is, in fact, able to remove or readjust almost any part of the body, and to correct displacements due to fracture, dislocation, or congenital defect. But there are many specializations of surgery, each with its own set of highly skilled procedures. For example, the ophthalmic surgeon performs a variety of extremely delicate operations within the eye or upon the eye-muscles or tear-ducts.

He may remove the lens when it is rendered opaque by cataract; he may alter the attachments of muscles to cure squint, or he may have to remove obstructions from the tear-ducts. The otologist similarly performs operations on the ear and its appendages: he may open an abscess inside the ear or in the mastoid, or may have to clear away an obstruction in the passage (Eustachian tube) that conveys air from the throat (pharynx) to the middle ear. The laryngologist has for his province not only the larynx or voice-box, but also the pharynx and air-passages. The gynæcologist is a surgeon whose speciality it is to deal with the organs of reproduction in women. In addition to operations for removing tumours or other diseased conditions of the uterus and its appendages, there are many surgical procedures for correcting displacements of the uterus, and especially for remedying prolapse of the uterus, bladder, or rectum. The obstetric surgeon performs operations of different kinds on women when there is difficulty in parturition. Such procedures may consist simply of altering the position of the child in the womb so as to facilitate its birth, or by means of forceps actively to help it to effect its birth. But in some cases the surgeon may have to open the abdomen and the uterus within it and bring the child out by this means. This Cæsarean Section, as it is called, is only resorted to when the pelvic cavity is so narrow that birth by the normal passage is quite impossible.

One of the most important branches of surgery is *orthopædics*, to which reference has already been made as the department of the art concerned with the correction of malformations, whether the result of injury or of congenital defect. As an outcome of the European War, the scope of orthopædic surgery has been widely extended. Not merely the results of direct injuries to limbs and the deformities so produced still call for the skilled treatment of the orthopædic surgeon, but also an even larger number of patients who have suffered damage to their nerves, with resulting paralysis of muscles and deformities of limbs. But the chief scope for the orthopædic surgeon's activities lies in the correction of congenital deformities, such as club-foot, and the prevention of the development of such conditions as hunchback.

Dental surgery is a highly specialized branch, the chief aim of which is essentially conservative, to remedy defects due to caries and other septic processes, and to prevent or correct irregularities of the positions of the teeth.

In fact the main purpose of surgery is essentially conservative, to remove conditions that might endanger life or cause serious suffering. It is impossible to estimate the extent of the boon conferred upon suffering mankind by surgery since its scope has been widened by the discoveries of Simpson and Lister. At the present time every qualified medical practitioner is required to have gone through a training to equip him for the work either of a physician or a surgeon. But in former times the craft of surgery was, to a large extent, in the hands of barbers; and the Company of Barber-surgeons, which was incorporated in London in 1540, lasted until 1745 before it gave place to the College of Surgeons, which had been in evidence since 1460, but was not incorporated until 1800. The Edinburgh College of Surgeons, however, was incorporated in 1505, and the corresponding college in Ireland in 1786.

Su'ricate (*Suricata tetradactyla*), an animal of the Cape Province allied to the ichneumon, sometimes domesticated as being an exterminator of rats, mice, and other vermin.

Surinam, the Dutch colony of Guiana (q.v.). Also a river of that colony, 400 miles long, navigable for 40 miles by large, and over 100 miles by small, vessels.

Surplice, a white garment worn by priests, deacons, and choristers in the Church of England and the Roman Catholic Church over their other dress during the performance of religious services. It is a loose, flowing vestment of linen, reaching almost to the feet, having sleeves broad and full, and differs from the *alb* only in being fuller and having no girdle nor embroidery at the foot.

Surrey, Henry Howard, Earl of, English soldier and poet, born about 1516, died 1547. He succeeded to the courtesy title of Earl of Surrey when his father became third Duke of Norfolk (1524). The Howards (q.v.) held an eminent position at the court of Henry VIII, and Surrey's cousin, Catherine Howard, became the king's fifth wife. Shortly before Henry's death Surrey and his father were suspected of aiming at the throne, and were arrested and lodged in the Tower, and Surrey was tried, condemned, and executed on Tower Hill. Surrey was one of the leaders of the early poetic movement under Henry VIII. Most of his poems were translations or adaptations of Italian originals. His translations of the second and fourth books of the *Æneid* are the first attempt at blank verse in the English language.

Surrey, a county of England, bounded by the Thames, separating it from Buckinghamshire and Middlesex; by Kent, Sussex, Hampshire, and Berkshire; area, 722 sq. miles. The North Downs stretch across the county from east to west, and on the south descend to the Weald, a flat plain extending into Kent and Sussex. Leith Hill (965 feet), near Dorking, is the culmination point of the North Downs. Almost the whole of the county is drained by the Thames, with its tributaries the Wey, Mole, and Wandle. Agriculture is progressive, but there are large heathy areas; market-gardening and sheep-rearing (on the Downs) are important. Hops are grown in Farnham area. The vicinity of the metropolis, and the beautiful sites which the county affords, have caused many parts of Surrey to be settled as residential areas, e.g. Kingston-upon-Thames, Richmond, &c. The county in its ancient area contained Southwark, Lambeth, and other metropolitan districts or boroughs; Guildford (county town), Godalming, Reigate, and the boroughs of Croydon and Wimbledon (London) are important. Pop. (1921), 930,377.

Sur′rogate, one who is substituted or appointed in the room of another, especially the deputy of a bishop or ecclesiastical judge. The chief duty of ecclesiastical surrogates is the granting of marriage licences.

Sur′turbrand, fossil wood, impregnated more or less with bitumen, found in great abundance in Iceland. It is used by the Icelanders chiefly in their smithies. It is sometimes so little mineralized as to be employed for timber.

Surveying is the art of determining the positions and heights of objects on the earth's surface, or merely relatively to each other. The field work of surveying consists of linear and angular measurements, which are carried out with a degree of precision depending upon the scope and importance of the survey. Geodetic surveys (see *Geodesy*) are those conducted with the direct object of determining the form and dimensions of the earth (e.g. the historic arcs of Peru and Lapland, begun by the French in 1735), and those whose extent and precision allow of their use for this object (e.g. the primary triangulation of Great Britain, and the great triangulation of India). Geographical, topographical, and cadastral surveys are those which portray the area surveyed on paper. *Geographical* surveying aims at the production of generalized small-scale maps; *topographical* surveying, of maps of more precision at medium scales; and *cadastral* surveys are for the delineation of property boundaries and the assessment of areas, and are therefore carried out at large scales. *Engineering* surveys with some specific end in view, such as the construction of a railway, dam, reservoir, &c., generally, but not invariably, aim at mapping an area at topographical or cadastral scales. *Mining* surveys require special methods for measurement underground, and *military* surveys may include all the above. The numerous errors, instrumental and personal, accidental and systematic, inherent to surveying processes, and the laws of the propagation of these errors, govern the choice of method and instrument for each particular case.

The Control.—In all surveys, which have more than a purely local significance, the first step is to construct a framework of points whose positions are known with precision. Upon this framework rests the subsequent survey of detail.

It will be as well to illustrate the construction of such a framework by describing, as a concrete case, that of the Ordnance Survey of the British Isles. The standard of length of the Ordnance Survey is an iron bar, upon which a length of 10 feet is defined by fine lines graved upon small circular platinum studs. Two bases, Salisbury Plain and Loch Foyle (6·9 and 7·9 miles respectively), were measured with Colby's compensating bars, in terms of a foot of the standard. These bases are directly connected with each other through the triangulation, and the difference between the length of Loch Foyle base as measured, and as calculated from the Salisbury base, is 1/93,000 of its length. A mean value was established between the two by lengthening the one and shortening the other, to eliminate this discrepancy. From these two bases a triangulation, comprising 552 triangles, is extended to cover the whole of the British Isles, and four other bases serve to ensure that no noteworthy errors have crept in. The six bases, widely separated from each other, tend to show that the length of any side of the triangulation includes no error greater than one 60,000th part of itself. The triangulation takes the form of a close network of triangles, forming one strongly connected figure. The mean length of a side is 35·4 miles, and the probable error of an angle, as deduced from the triangular errors, is 1·23 seconds. As is usual in such triangulations, the whole network is adjusted in a mathematical analysis depending upon the theory of least squares, so that the length of any one side calculated from any other by all possible different paths through the triangulation remains the same. Astronomical observations for latitude, azimuth, and time were made at a large number of stations, and calculations for the relative positions on the spheroid are based on Airy's figure of the earth $\left(a = 20{,}923{,}713 \text{ feet; compression, } \frac{1}{299{\cdot}3}\right)$.

A modern primary triangulation generally forms an open grid of adjusted lines of triangulation rather than a continuous interconnected figure, and the probable error of an angle observed with modern instruments is about 0·4 second. Modern bases are generally measured with invar tapes or wires suspended in catenary, and tend to become more numerous and individually longer, although no more accurate than the older type.

Within the area covered by the primary triangulation, and depending upon, or adjusted to it, come a second, third, and possibly a fourth order of triangulation. These descending orders break up the large main triangles until fixed points, every mile or every 2 miles apart, afford a sufficient control for surveys of detail. The inferior orders of triangulations are occasionally replaced by traverses, but only in cases where the difficulty and cost of triangulation render it prohibitive. The subject of traverses generally will therefore be considered under 'Detail Surveying'.

Control points may be fixed by resection from a number of already known points. Resection depends upon the fact that any three points (A unknown, and B and C known) lie upon a circle whose radius can be calculated from the known length BC, and the observed angle O, subtended at A. When three known points, B, C, D, are observed upon, the point A, where the circles ABC and ACD cut each other, can be calculated by one or other of a variety of solutions, or determined graphically on the plane-table. Resection is particularly important in marine surveying, and a mechanical solution of the three-point problem with the 'station plotter' is commonly used.

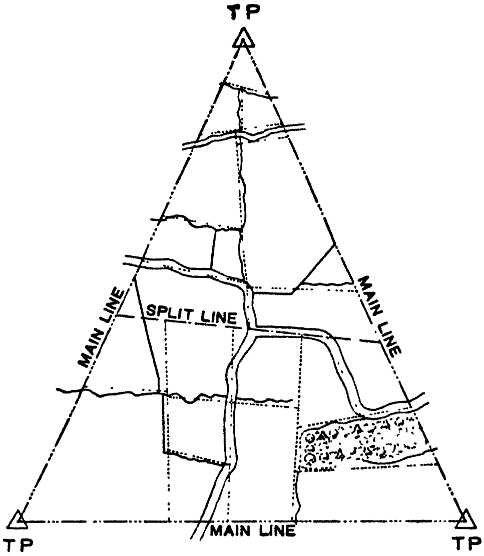
Field Astronomy.—In order to place any survey in its correct position upon the earth's surface, it is necessary to know, or to fix by astronomical means, the latitude and longitude of one point and the azimuth of one point from another. In field astronomy we imagine the earth to be a point of negligible dimensions in the centre of a hollow sphere, upon the surface of which the sun and stars revolve around a prolongation of the earth's axis. The positions of the sun and stars on this sphere at any moment are known, and tabulated in the *Nautical Almanac*. Now, if we consider the position of any star relatively to that of an observer on the earth's surface, we see that its altitude (or height above the horizon) and azimuth (bearing from true south by west) will vary according to the latitude and longitude of the observer (see *Navigation*). From suitable observations, and by consulting the *Nautical Almanac* for the date and time of observation, we may solve the *astronomical triangle* whose apices are the observer's zenith, the elevated pole (north or south), and the heavenly body, and may then calculate the latitude of observation, the local (solar or sidereal) time, or the azimuth of any point included in our observations. Observations and calculations for latitude, azimuth, and time present few difficulties, but are burdened by the error in the observed altitude, due to 'local attraction' (see *Geodesy*). In order to determine longitude, we must know both local and Greenwich times of observation, the difference between which is the required longitude. Local time is calculated from the astronomical triangle. Greenwich time is obtained generally (in modern practice) by an interchange of telegraphic signals at stated intervals, between the point of observation and some other point whose longitude (and therefore Greenwich time) is already known. It may also, and with great advantage, be procured by receiving by wireless telegraphy the time signals sent out from the Paris or Berlin wireless transmitting stations.

Detail Survey.—Once the controlling framework of points has been completed by triangulation, the topography may be mapped in detail by a variety of methods of less precision and expense. These methods may be classed under the following headings: (1) Traversing, (2) Chaining, (3) Tacheometry, (4) Plane-tabling, (5) Photogrammetry (q.v.).

A golden rule of surveying is, that no step in the work should remain unchecked. None of the above methods of survey should be considered final, and the survey or plan should not be considered complete until the result has been subjected to a check on the ground.

(1) *Traversing.* — A traverse consists of a number of measured lengths and bearings forming a connected series. The linear measurement may be carried out with tapes or bands of invar or steel. or optically by tacheometry. The angles may be observed with theodolite, sextant, or compass. Traverses which replace the lower orders of triangulation generally start from one point of the triangulation, and close upon another. Their lengths are measured with standardized metallic tapes, and their bearings with good transit theodolites. Traverses run for the survey of detail are carried out with less precision, and form a record from which may be plotted the positions of the details of topography along the line of the traverse and within a short distance on either side of it. The errors of linear measurement in traversing may be taken to accumulate in proportion to the square root of the distance traversed. Angular errors, due to imperfect centring of theodolite and signals, &c., may also be said to accumulate in proportion to the square root of the number of stations. There is, however, no possibility of definitely assessing the error in position of any point of the traverse other than the starting and closing points. It is usual in adjusting a traverse to its controlling points to make use of the following rule: "As the arithmetical sum of all the latitudes (or departures) is to any one latitude (or departure), so is the whole error in latitude (or departure) to the correction to the corresponding latitude (or departure)." Traverses are often so run as to form a closed figure or polygon. In such cases the sum of all the interior angles should

be equal to ($2n \times 90 - 360$) degrees, where n is the number of sides to the figure. Particular care should be taken in the standardization of the band or chain used for linear measurement, in order to prevent errors of scale upon which no check will be possible. In long traverses, check azimuths observed on the sun or stars are a valuable adjunct, and no opportunity should be missed of including, at any station from which it is possible, observations to other points whose positions are already known.



(2) *Chain Surveying.*—Chaining, the oldest method of detail survey in common use, is still the most effective for cadastral or large-scale work. In essence it consists merely of measuring straight lines on the ground between points which are already fixed, noting where these lines cut the detail to be mapped, and 'offsetting' to other suitable points. It becomes then, in theory, a form of traversing; but as the figure chained is rigid (if all lengths be known), angular measurement is not required. The control (from triangulation or traverse) having been established, three fixed points are selected, and the sides of the triangle formed by them are first 'traced' on the ground and marked with flags or staffs and then chain measured. These sides are called *main lines.* *Split lines* are lines which cut up the triangle into suitable blocks for the detail surveyor. The points between which these split lines run are chosen and marked during the tracing of the main lines. *Detail lines* are those which are run between points, chosen on main and split lines, in such a way as to complete the survey begun by the first two processes. Finally, the *offsets* consist of short distances measured at right angles to, and at either side of, each type of line, to provide that every point of the area to be surveyed is actually plottable from the field book.

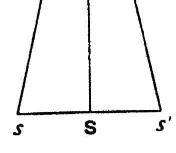
The stores required consist of a small theodolite for tracing lines, a chain or steel tape for measuring distances, and *arrows* which mark the terminals of each chain or tape length.

The errors which are allowed in the chaining and the length permitted for offsets are the subject of special rules governed by the importance of the survey. Generally, for surveys at a scale of about 1/2000, we may say that (*a*) the distance between control points should not be greater than $1\frac{1}{4}$ miles; (*b*) the difference between the calculated and measured length of any line should not exceed 1/1000 of that length; (*c*) offsets should not be more than 30 feet.

(3) *Tacheometry.*—Tacheometry (or *rapid measurement*) aims at measuring the bearing and distance to one or more stations and fixing their polar co-ordinates with reference to the position (supposed known) of the tacheometer or theodolite. The theory is exceedingly simple.

Let T be the position of the tacheometer, and S the station to be fixed. Let RO be some reference mark whose bearing from T is φ, let ss' be a short base of known length l, and θ be the angle subtended at T by l. Let α be the horizontal angle at T between S and RO. Then the bearing of S from T is $\varphi \pm \alpha$; and the distance of S from T is $\frac{l}{2} \cot \frac{\theta}{2}$.

In practice this general idea is developed in two ways according as θ is a fixed angle, defined by hairs or lines in the diaphragm, and l is variable, or l is a fixed distance and θ is measured (generally by repetition) on the horizontal or vertical arcs. In both cases l is small compared to TS, and the accuracy of these methods is



therefore poor. The term tacheometry is usually confined to the first of these two ways, where θ is fixed and 1 variable, and the second is usually known as subtense.

A tacheometric survey is carried out by parties averaging six to eight men. An observer reads the instrument and calls out his results to a computer, who books and calculates horizontal and vertical distances. Bearings are generally plotted direct upon a plane-table on which the tacheometer stands (although they may be read, booked, and plotted subsequently); four to six *rodmen* move as directed, and hold their graduated staffs vertically on the spot indicated. The lines or hairs in the diaphragm are usually so disposed as to intercept 1, 2, or 3 feet on the staff at a distance of 100 feet, and the calculation of distance is one of simple proportion if the subtended angle is measured at the axis of the instrument. In the ordinary theodolite, however, such is not the case, for with fixed wires the angle is actually measured at a spot in front of the axis, and a constant must therefore be employed in calculation. In modern tacheometers, however, an *anallatic* lens (which reduces angles to the axis) is inserted between the object glass and diaphragm.

If the rod or staff be on a different level to the observer, the computations for the horizontal and vertical distances require the use of sines and cosines. To replace this calculation on paper two instruments have been devised. The *Beaman arc* can be fitted to any tacheometer, and reads direct in sines and cosines, and the *Cooke's direct-reading tacheometer* gives all the necessary data for a much simplified calculation from the readings of the positions of three needles in the field of view. Sights are usually confined to distances of from 200 to 250 yards.

As a method tacheometry is useful for mapping at medium scales (1 : 20,000 to 1 : 5000), and for engineering surveys, such as railway location, catchment basins, &c. It is unsuitable for employment at small scales, and at large scales finds a serious rival in chaining. Subtense methods, of less general application, are more useful for mapping at small scales, and for occasional use in areas of particular difficulty. The fixed base may be improvised in many different ways, and may, for example, take the form of the measured distance between two poles (as has occurred in tropical surveys) or the measured length of the cleaning-rod of a gun (in military surveys). The subtended angle measured on the horizontal arc is generally repeated, say, ten times, the extreme readings only being booked, and the result divided by the number of repetitions. Sights may be taken up to the limits of visibility if the base be sufficiently long, but in practice are seldom more than 1 mile.

(4) *Plane-tabling.*—A plane-table consists of a flat table which stands upon a tripod, and designs of plane-tables vary from highly finished, elaborate instruments, embodying slow motions for all movements, to simple strong tables, levelled by moving the legs and oriented by hand. Plane-tabling consists in determining graphically the positions of a number of points additional to the controlling triangulation, by the intersection of rays or by resection, and of filling in intermediate detail by eye. In the hands of a well-trained topographer the plane-table is an accurate and reliable instrument, and large areas in India and Africa have been mapped in this way. It can be used with advantage for medium and small scales (1 : 20,000 to 1 : 250,000), but is not suitable for large scales except as an adjunct to the tacheometer. It is a useful auxiliary to phototopography, for by its means a number of natural objects, such as appear clearly on a photograph, can be fixed quickly and accurately.

The Vertical Control.—No survey would be complete which did not include the determination of relative heights. For this reason a vertical control is necessary to govern the contouring, just as a horizontal control governs the detail survey. The vertical control is supplied in most important surveys by spirit levelling (see *Levelling*). In topographical surveys it is generally provided by calculation depending on known distances and angles of elevation and depression, observed with the theodolite or tacheometer and clinometers. Altitudes fixed in this way are generally known as *trig* or clinometer heights. In geographical or small-scale topographical maps, heights are fixed occasionally with the hypsometer, and more often with the aneroid barometer.

Contouring, controlled by the bench marks of the spirit levelling or the trig clinometer or barometric spot heights, may be filled in in a variety of ways. The most accurate method is to level, up or down, from a bench mark to any spot at the height of the contour required, and then to mark the contour on the ground by pegs, between each pair of which the level is set up. The positions of the pegs are then surveyed. The *water level* may be used for this *tracing* process. In engineering surveys, contours are generally sketched in between the number of fixed positions and heights provided by tacheometric surveying. In topographical surveys, contours are sketched in from a control of clinometer heights. The accuracy of the contouring in engineering and topographical surveys depends largely on the practice and skill of the surveyor. They may be indistinguishable from spirit- or water-levelled contours, and they may, on the other hand, be mere form-lines.

Note.—Older methods of obtaining longitude astronomically, by occultations, transit of chronometers, &c., gave results of much less precision.

BIBLIOGRAPHY: (Precise Control Work) Mansfield Merriman, *Elements of Precise Surveying and Geodesy*; (Topographical Surveying) Colonel C. F. Close, *Text Book of Topographical Surveying*; H. M. Wilson, *Topographical Surveying*; (Geographical Surveying) A. E. Reeves, *Hints to Travellers*; (Engineering Surveys) Norman Thomas, *Surveying*; (Photogrammetry) E. Deville, *Photographic Surveying*; Lieutenant-Colonel M. N. MacLeod, *Mapping from Air Photographs*; Dr. C. Pulfrich, *Stereoskopisches Sehen und Wissen*; Wharton and Field, *Hydrographical Surveying*; G. L. Leston, *Land and Mine Surveying*.

Susa, an ancient city of Persia, the capital of the province of Susiana (Elam), was situated in the plain between the Kerkha (Choaspes) and the Dizful. It was a very extensive city, with a strongly fortified citadel, containing the palace (see *Esther*, i, 4–6) and treasury of the Persian kings, whose chief residence it was from the time of Darius I. It is the Shushan of *Daniel* (viii, 2) and *Nehemiah* (i, 1).

Susa (ancient Hadrumetum), a seaport of Tunisia, on the Gulf of Hamâma. The chief exports are oil, grain, phosphates, sansa (olive refuse), and esparto. Pop. 25,000.

Susannah, Book of, is one of the apocryphal additions to the book of *Daniel* which are found in the Greek versions of Theodotion and the Seventy. They have not been found in any Hebrew original, and are generally rejected by the Jews. It is the story of a beautiful and virtuous woman loved by two Jewish elders, whose proposals she rejected; accused of adultery by the two rejected lovers, her innocence was proved by Daniel.

but it is generally unnavigable.

Sussex, a southern maritime county of England, with a coast-line of 91 miles on the English Channel; area, 1466 sq. miles. The rivers — the Arun, Adur, Ouse, and Rother — flow to the English Channel. The great physical feature of the county, the South Downs (Ditchling Beacon, 813 feet), is chiefly used for rearing the famous South Down sheep. To the north of the South Downs range is the valley of the Weald, which forms the larger part of the county, whose eastern boundary overlaps the Kentish hop area. Agriculture is progressive, and a considerable area is under timber. Numerous health-resorts and watering- or bathing-places are found along the Sussex shores, e.g. Brighton, Hastings, Eastbourne, Worthing, Littlehampton, Shoreham, Bexhill, Hove, and Bognor. The county is rich in archæological remains, among which are the castles of Pevensey, Bodiam, Hastings, Arundel, Bramber, and Hurstmonceaux. Pop. (1921), 728,001.

Sutherland (su*th*'ėr-land), a maritime county of Scotland, extending between the North Sea and the Atlantic; area, 2030 sq. miles. The interior consists of an ancient dissected plateau (Ben More, 3273 feet), with picturesque valleys and glens and broad moorlands. Along the west coast there are several fine sea-lochs. Dornoch is the county town. Dunrobin Castle is the seat of the Duke of Sutherland. The principal streams are the Oykell, Brora, Helmsdale, Halladale, Naver, and Hope. The principal lochs are Loch Shin, Loch Naver, Loch Hope, Loch Assynt, and Loch More. There are valuable salmon fisheries in several of the rivers. The greater part of the county is fitted only for grazing, but on the eastern coastal plain oats and barley are cultivated, and even wheat religious aphorisms and rules, including all the ritual, grammatical, metrical, and philosophical works, and consisting of brief sentences to be committed to memory. These were usually written on dried palm leaves tied together by a string.

Suttee′ (Skt. *satī*, an excellent wife), a European term applied to the self-immolation of Indian widows on the funeral pile of their deceased husbands. The origin of this practice is of considerable antiquity, but it is not enjoined by the laws of Manu, nor is it based on the Vedas. It was abolished by Lord William Cavendish-Bentinck, afterwards first Governor-General of India, in Dec., 1829, but cases are still occasionally heard of.

Sutton Coldfield, a municipal borough of Warwickshire, England. It is a favourite place of residence with the business people of Birmingham, Walsall, and other towns. Pop. (1921), 23,028.

Sutton in Ashfield, an urban district and market town of Nottinghamshire, England. Manufactures include cotton, hosiery, and thread, and in the vicinity there are collieries. Pop. (1921), 24,000.

Suvo′rof-Rymnikski, Peter Alexis Vassilivitsh (his name is also spelled *Suwarof*, *Suwarrow*, &c.), Count of, Prince Italiski, field-marshal and generalissimo of the Russian armies, was born about 1729 or 1730, died in 1800. In his seventeenth year he entered the service as a private soldier. He served in the war against Sweden, in the Seven Years' War, in Poland, and against the Turks, giving many proofs of courage and ability, and obtaining the rank of lieutenant in 1754, of lieutenant-colonel in 1763, of brigadier-general in 1768, and of general of division in 1773. In 1783 he reduced the Kuban Tatars under the Russian yoke. In 1787, as chief in command, he conducted the defence of Kinburn to a successful issue; and in 1789 he gained the dignity of count by his great victory on the banks of the Rymnik, where the Austrian troops, under the Prince of Saxe-Coburg, were surrounded by 100,000 Turks. By his timely arrival with disasters of the allies [illegible] brilliant victories at Piacenza, Novi, &c., drove the French from all the towns and fortresses of Upper Italy, and was rewarded with the title of Prince Italiski. But in consequence of a change in the plan of operations he passed the Alps; and the defeat of Korsakov at Zurich, together with the failure of the expected assistance from the Austrians, obliged him to retreat from Switzerland. On his recall to Russia, preparations were made for his triumphal entry into St. Petersburg (Petrograd); but having incurred the displeasure of the Emperor Paul, the preparations for his triumph were suspended. Chagrin at this disgrace hastened his death.

Swahili, a name given to the inhabitants of a considerable part of the coast of East Africa and the adjacent islands, a people of mixed Arabic and native African origin. They form the most important part of the subjects of the Sultan of Zanzibar, and their language is the common medium of intercommunication in East Africa.

Swallow, the general name for all the insessorial birds of the family Hirundinidæ, distinguished by their long and powerful wings, their short broad beak, their wide gape, their comparatively small and weak legs and feet, and their habit of hawking on the wing for insects, which constitute their food. They are found all over the world except in the coldest regions, and there are a number of species. Three are British, the common or chimney swallow (*Hirundo rustica*), the house-martin (*H. urbica*), and the sand-martin (*H.* or *Cotile riparia*). The common swallow has the nostrils concealed by a membrane in front, and the outer feathers of the tail much elongated. It is about 8½ inches in length. The top of the head is reddish-chestnut in colour, the back and wings being steel-blue. The tail and secondary feathers are black, a dark-blue patch existing at the upper part of the chest, whilst the throat is a chestnut-brown. The beak, legs, and toes are black, and the under parts are white or greyish. The females possess the chest-patch, and also the forehead patch of red, of smaller size than the males. The song is at best a mere twitter. The nest consists of a cup-shaped structure of mud or clay, sometimes built a few feet down an unused chimney, often close under the roof of some outhouse to which ready access is obtained, and is lined inside with soft grasses, feathers, and other materials. The migration of the common swallow has always attracted attention from the well-known and unvarying character of the movements of these birds. In Britain they fly southwards about the end of October, or sometimes sooner, to winter in Africa, some finding their way to India, and they arrive again in Britain in the succeeding April. They generally return to the nests they have constructed, and appear to exhibit great distress on finding their former home swept away. Swallows bear a considerable resemblance to swifts (q.v.), and among the swifts are several forms which are popularly named ‘ swallows ’. Thus the bird known in North America as the chimney swallow is not a true swallow, but a swift (*Chætūra pelagica*). The swallow that produces the edible nest is also a swift. Of true swallows, however, several are American, and among them the barn swallow (*H. horreorum*), very similar to the European chimney swallow, the purple martin (*Progne subis*), and the cliff swallow (*Petrochelīdon lunifrons*). The name of ‘ sea swallow ’ is given to the tern (q.v.). See *Martin*; *Sand-martin.*

Swallow-tailed Butterfly and Moth, names given to the *Papilio machaon*, a beautiful species of butterflies, and to the *Uropteryx sambucata*, a common British moth, so called because the hinder wings are prolonged into small tails.

Swammerdam, Jan, Dutch naturalist, born 1637, died 1680. He was devoted especially to the study of insects; and his *General History of Insects* and other works laid the foundations of the modern science of entomology.

Swan, Sir Joseph Wilson, English inventor, born at Sunderland in 1828, died in 1914. His inventions include rapid dry plates, bromide paper, the carbon or autotype process, and other improvements in photography, the incandescent electric lamp, a miners' electric safety lamp, and improvements in photo-mechanical printing and electro-metallurgy. He was a Fellow of the Royal Society and a Chevalier of the Legion of Honour, and received the honour of knighthood in 1904.

Swan (Cygnus), a genus of swimming birds, sub-family Cygninæ of the duck family (Anatidæ), distinguished as a group by the bill being of equal length with the head, and broad throughout its length; by the *cere* being soft; by the front toes being strongly webbed, whilst the hinder toe is not webbed, and has no lobe or under-skin. The species which inhabit or visit Britain are the mute or tame swan (*C. olor*), the whooper, whistling, or wild swan (*C. musicus*), and Bewick's swan (*C. bewicki*). The mute or tame swan, so named from having little or no voice, is the only species which is permanently resident in Britain. The nest is constructed of reeds and grasses, and is generally situated near the edge of the water on some islet. The young (‘ cygnets ’) when hatched are of a light bluish-grey colour. The food consists of vegetable matters, smaller fishes, worms, &c., and fish-spawn. The wild swan and Bewick's swan pass the winter in Great Britain, flying northward in the spring. The first is a native of Iceland, Eastern Lapland, and Northern Russia; the second has its home farther east. They have their representatives in North America in the trumpeter swan (*C. buccinātor*), and the *C. columbianus.* South America produces one very distinct species, the beautiful black-necked swan (*C. melanocoryphus*). The black swan (*C. atrātus*) of Australia, like the white swan, is frequently kept as an ornament in parks or pleasure-grounds. Its large size, and the gracefulness of its form and motions, render the swan one of the most ornamental of all the water-birds. In England, from a very early date, it has been specially protected by both legal and regal interference. In Henry VII's reign the theft of a swan's egg was deemed an offence punishable by a year's imprisonment. Swans themselves, at a prior date, were declared to be exclusively ‘ royal ’ or ‘ king's ’ property; and no subject was entitled to hold possession of these birds, save under special favour from the sovereign. To such subjects as possessed the permission to keep swans a special or ‘ swan ’ mark was attached, and this mark was cut on the bill of the bird as a distinctive badge of ownership. The process of marking is known as ‘ swan-upping ’ or ‘ hopping ’, and the ceremony is yet annually carried out on the Thames on behalf of the Crown, and certain of the London guilds or companies.